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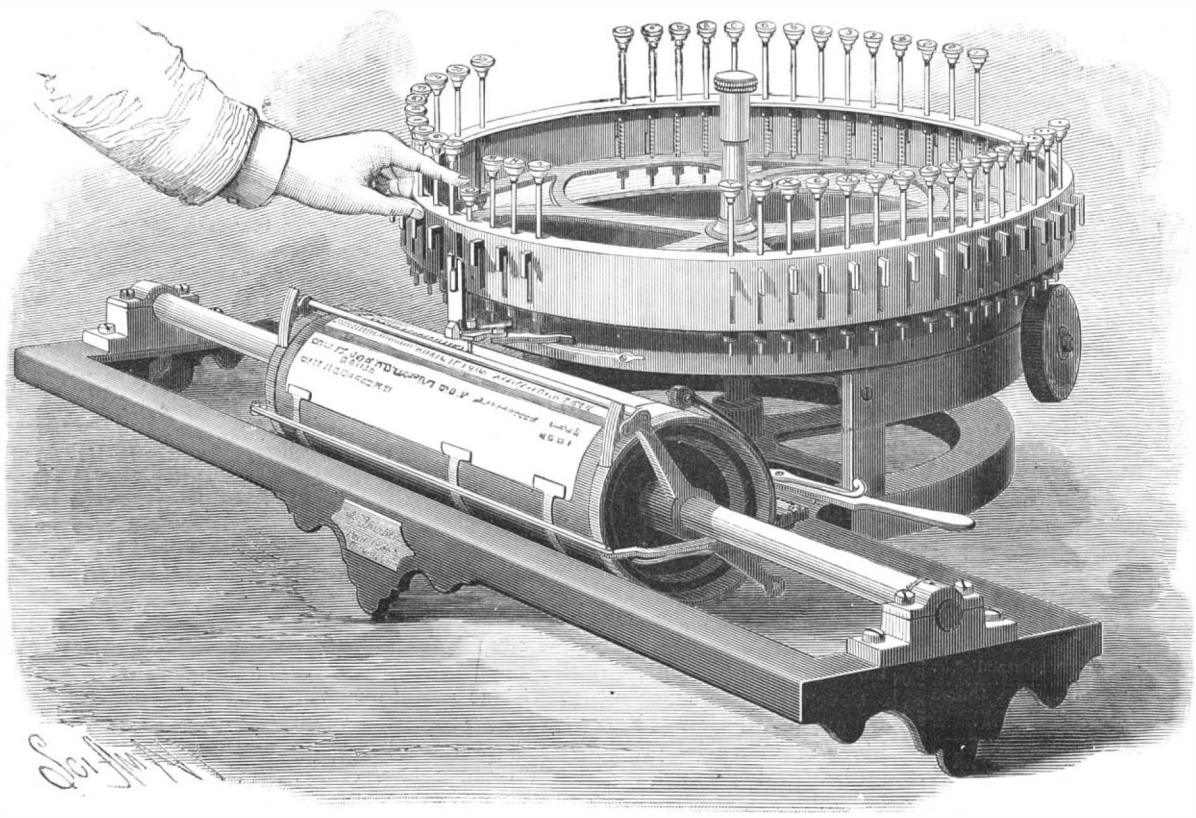
THE FIRST AMERICAN TYPE WRITER.

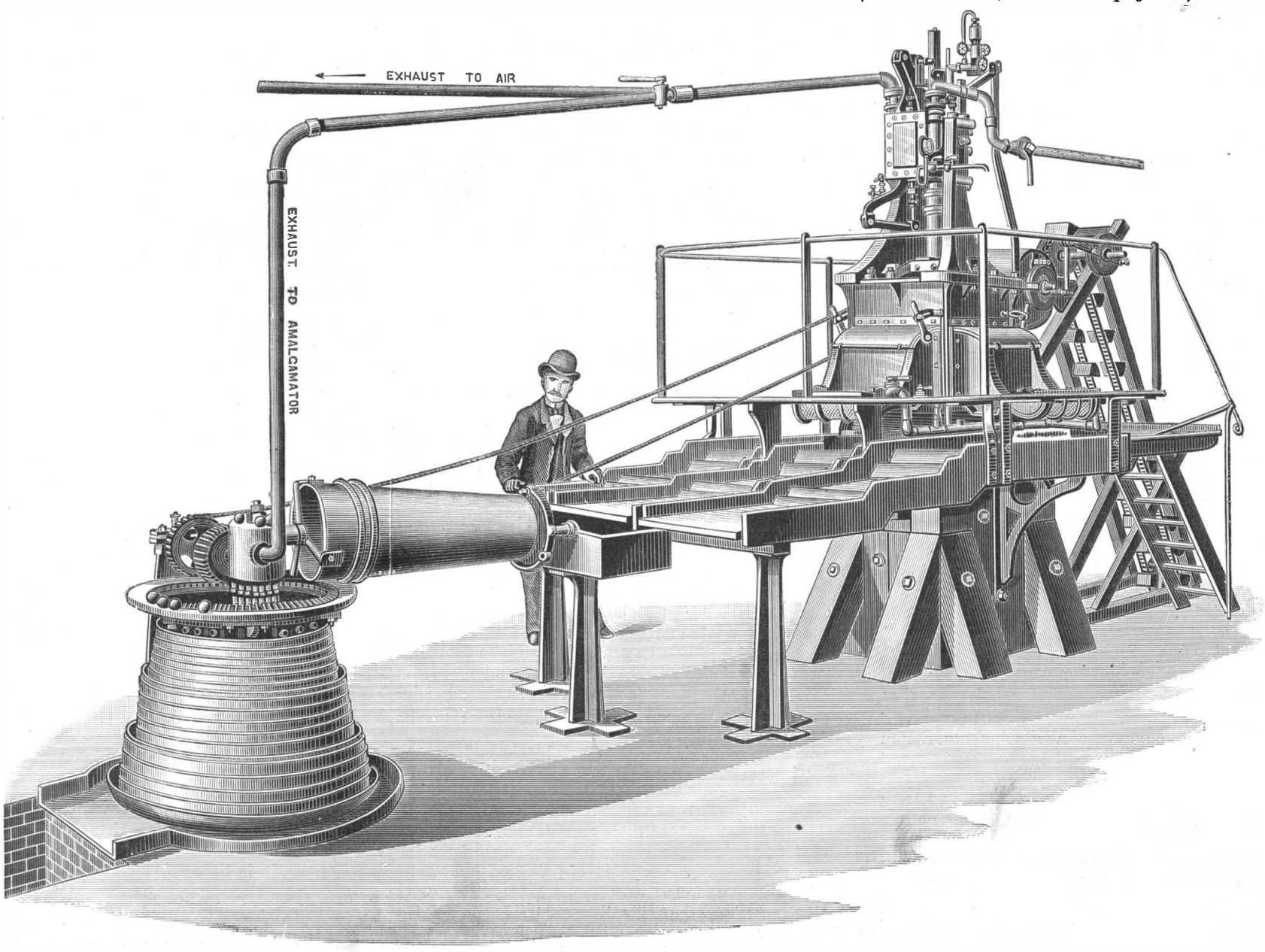
In the old Patent Office reports for the year 1843 may be found indexed on page 360, under the name of Charles Thurber, of Worcester, Mass., a "Machine for Printing." The date of issue is August 26, 1843. Under the system then in vogue, it was placed in class XVIII., "Arts Polite and Ornamental." Two years later, in the 1845 report, on page 1208, his name again occurs, this time as of Norwich, Conn. His second invention is termed a "Writing Machine." The patent was issued on November 18. As far as the records show, these were the earliest efforts of invention in this country in the development of a mechanical writing machine. The product of Charles Thurber's work and invention is illustrated here. It shows what may be properly called the first American type writer. The late Charles Thurber was successively a resident of Worcester and of Norwich. Early in life he became interested in the project of inventing a machine that would take the place of pen and pencil for those who were blind or otherwise incapacitated for or unable to write satisfactorily. The work was taken up at the request of a Southern gentleman of means, to whom writing was a very irksome employment. The two patents and the present machine, as far as known, are all that exists to show what Thurber did.



THE FIRST AMERICAN TYPE WRITER.

The actual machine varies in many respects from the device shown in his first patent. Many improvements were introduced, and the apparatus, as finally completed, was found perfectly efficient except as to the element of time. Its operation was so slow that it was practically abandoned, and few, if any, others were made. Thus the machine illustrated is a most interesting relic. It was not known to be in existence until within a few years. The Hon. C. B. Pratt purchased the residence and effects of Mr. Thurber at Worcester when the latter moved away. Then a search was made for the type writer, and, after many days, it was found stored away among a quantity of machinery and other apparatus. There it had lain for over twenty years, during which period no care whatever had been bestowed on it, and its massive construction is about all that saved it from total wreck. As it was, it had become badly corroded, and many parts were broken. Mr. H. R. Cummings, of Worcester, gathered up what was left of it with veneration. He had it

(*Continued on page* 276.)



IMPROVED ORE CRUSHER AND AMALGAMATOR.—[For description see page 276.]

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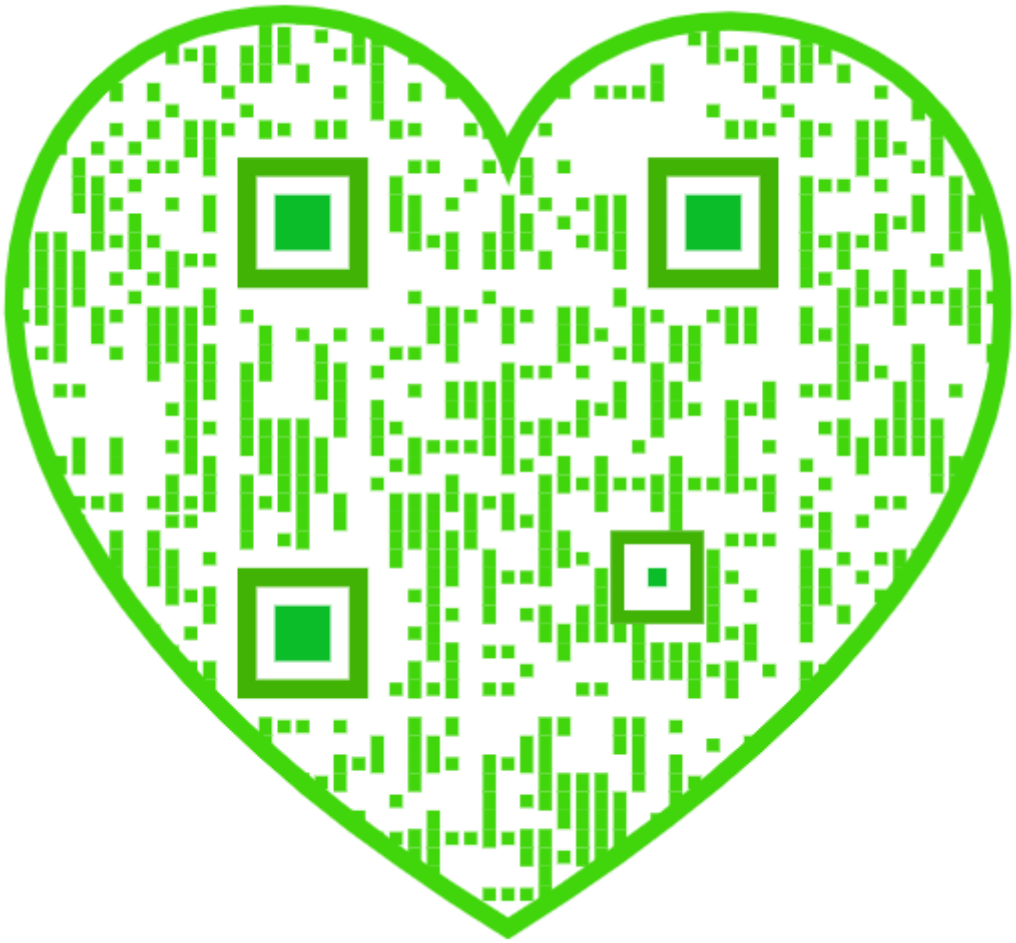

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NEW YORK, SATURDAY, APRIL 30, 1887.

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THE UNITED STATES JOINS THE INDUSTRIAL UNION.

By concurrence of the Senate on March 2 last, the government of the United States is about to become a member of the International Union for the Protection of Industrial Property. The official papers signifying the desire of this government to enter the Union are now being prepared by the State Department for exchange at Berne, Switzerland; and in a few weeks, probably, the inventors, merchants, and manufacturers of this country will be entitled to share in all the benefits the Union can yield.

The vast advantages which have accrued to the nations composing the International Postal Union are well understood. The Industrial Union is designed to confer equal benefits, but in another direction. One of its special objects is to secure better protection for patents, designs, models, inventions, trade marks, and trade names. For example, at the present time, when a patent is issued here to an American inventor, he loses the right to obtain a patent in most of the European countries. He is therefore obliged to secure his foreign patents before the American patent issues, and he aims to have all the patents issue on the same date; otherwise there is liability of invalidation of the foreign patents, while if the latter issue first, the term of the American patent is abridged. The American inventor is also subjected, at present, to the risk that outside parties may secure his invention in other countries in their own names, and deprive him of all right thereto. These and other difficulties will be removed when the United States enters the Industrial Union. One of the special provisions of the Union is that inventors, patentees, and proprietors of designs and trade marks shall have a prior right of registration in all countries or nations that are members of the Union. The term of this priority for Americans is seven months as respects patents, and four months for trade marks. This provision is likely to be of great importance to our inventive countrymen. The regulations of the Union will also apply in favor of its members in respect to protection against infringers.

Several other excellent provisions pertain to the Union, which extends the ægis of its protection to all kinds of industrial property and products, including agricultural productions, wine, corn, fruits, cattle, minerals, etc. We shall take occasion in future articles to explain more fully the nature and workings of the new institution.

ANT-EATER AND PENGUIN.

It is a long while since anything so curious nas arrived at the port of New York as the two live specimens which are now safely caged in the Philadelphia Zoological Gardens. The first of these is a live ant-eater (*Tachyglossus hystrix*), or echidna, an animal that lays eggs, and the other a penguin, a bird that cannot fly, belonging to a sub family of web-footed creatures living at sea, sometimes seen at a distance of 300 miles from shore, but usually found near rocky islands and headlands or ice floes and fields. The ant-eater, because of its peculiarities of structure, its restrictions as to diet, and the infrequency with which it brings forth young, has often been quoted, and not without reason, it would seem, as additional evidence in support of the theory of foreordination, the prearrangement of the universe to suit its occupants, or, what is quite the same thing, the nice adjustment of live forms to their surroundings.

Were the ant-eater as prolific as other animals, his race would long since have become extinct, because there is not enough food to go around of the kind he subsists on, or, if he came into existence where there were no collections of ants, and without the ability to get at the eggs of birds, nature could no longer be called an economizer.

Speaking of such live forms as the ant-eater and those curious insects and fishes which have a protective resemblance, the late Professor Agassiz said:

"The existence of a superior intelligence, whose power alone can establish and sustain such an order of things, I consider to have been established by rigid demonstration and on a truly scientific foundation. Species do not insensibly pass into one another, but each has its appointed period, and is not connected, except in the order of time, with its predecessor. An invisible thread, in all ages, runs through this immense diversity, exhibiting, as a general result, the fact that there is a continual progress in development, ending in man, the four classes of vertebrates presenting the intermediate steps, and the invertebrates the constant accessory accompaniment."

One young one is brought forth by the ant-eater at long intervals. The young one attaches itself to its mother's back, and does not quit this position for more than a year. Curiously enough, nature seems to have calculated that food suitable for this animal is scarce, and that, at times, it must endure prolonged fasts, because the ant-eater is capable of going without food for incredible periods.

The new arrival, unlike its cousin (*Myrmecophaga jubata*), or ant-bear, can climb trees, and thus secure the eggs of forest birds, which it readily gets to its mouth by means of its long cylindrical tongue. Before it started for Philadelphia the other day, it was given the white of an egg mixed with condensed milk, and seemed to enjoy it immensely. The lightning-like quickness with which it thrusts in and out its long glutinous tongue would seem marvelous, did we not know that the tongue of the toad is still quicker.

The Philadelphia specimen is covered with quills like the porcupine, in this respect differing from the great ant-eater, which has long hair in place of quills, and, where the ground is ordinarily soft, can bury himself below the surface in an incredibly short space of time. Unlike most burrowing animals, he uses all four feet at the same time, and sinks into the ground in much the same fashion as a harlequin at the pantomime disappears through the stage on a descending trap. His spine curved, and the formidable quills standing out threateningly, like the retrenchment called in military parlance *chevaux de frise*—a piece of timber traversed with spikes, used to stop cavalry. He is slow and awkward of gait, indeed cumbersome, and, as his claws turn inward, he cannot bear the weight of his body upon the soles of his feet, but must needs walk upon the callous pads formed on the back of the claws, and which cover an entire phalanx, or the space between two joints. Besides the purely defensive quills, it has a sharp pointed spur on the inside of its right hind leg, similar to those worn by the fighting cock. This spur is hollow, like a serpent's fang, and resembles it again in having at its base a sack of venom, which, pressed against by the spur during attack, injects its poison into the wound made by the spur.

The newly arrived penguin is one of those curious birds only found in uninhabited and remote spots, and which, when out of the water, stands upright in long rows, silent and motionless, like sections of a great army in battle array, line upon line *en echelon*, that is to say, in the form of steps. Each line represents a distinct condition; the young being in one, those of perfect plumage in another, while the other lines are made up of those moulting and sitting upon eggs. The penguin can neither fly nor walk, and while moving over the rocks lies flat and propels itself along by means of its wings, which it uses like anterior limbs. In the water, however, it is at home, moving under the surface as actively as a fish.

How Wood is Made.

In many trees the annual layers are so regular, and seem to be placed so nicely, that one not a botanist might be pardoned for believing that the sap was changed to wood matter in the leaves, and the new formed matter sent down, sliding over the old layer like the section of a telescope; but, though the food was prepared by the leaves in a great measure, the actual growth was made by the germination of some of the cells along the whole outside wall of last year's wood beneath the inner bark. The germination of the cells takes place about the middle of June. Take a healthy cherry tree, and strip it entirely of its bark to any length desired. At that season a viscid liquid will be found covering the woody surface in abundance. The stripped part is covered with a cloth to prevent evaporation, and in a few days numerous dots, like needle points, will be seen about the sixteenth of an inch apart all over the surface. These are the young cells which have germinated from those of last year. They continue germinating, one from the other, until they meet, when they unite and form a complete surface.

In the autumn a layer of wood will be found just as thick as in the part of the tree not disbarked, and a single layer of liber, with its outer coat of cellular matter—perfect bark—will have been formed over the whole. The entire formation of wood and bark can thus be seen by the ordinary observer without the necessity of any nice microscopical work. Other people have tried the experiment with other trees. We have seen large apple trees that have had their bark peeled wholly off from their trunks, at the season named, make an entire new layer of bark and wood, not only with no injury to the tree, but to its manifest enjoyment; but our own experiments were confined exclusively to the cherry. By this experiment we learn that there is no difference primarily in any part of the annual covering. The same cell may become permanent tissue or generating tissue, and from the generative tissue may come, before the season of growth closes, every form of structure known to anatomists, from pure wood to the outermost cuticle of the bark. How these cells become differentiated may be passed over here. We know that cell growth is not always uniform in its operations. The law that changes the outermost series of newly made cells into liber need not necessarily operate so exactly as to make them perfect to this end—a few may be thrown off into the liber as generative tissue—and, granting this possibility, we see how the woody granules in the apple are formed.—*The Garden.*

IN Russia, on the northern railways, the locomotives, hitherto burning wood or coal, are being adapted for peat burning, the saving being estimated at fifty per cent.

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The Nature of Patent Rights.

In a recent jury trial for the infringement of a patent, Judge Carpenter, of the United States Circuit Court, Massachusetts, gave the following interesting explanations to the jury concerning patents and their nature:

"It may be useful for you to understand in a general way what is the nature of these rights that are called 'patent rights,' and of which this claim which is brought here is one. You know to how large an extent the progress of the country has depended upon new and useful inventions in the mechanical and other useful arts, and the attention of the Congress was early turned, in pursuance of the Constitution, to the consideration of what methods ought to be adopted, in the first place, to protect the rights of inventors, and, in the second place (which is equally important), to protect the rights of the public. In order to accomplish these two results, the patent laws have been enacted, which provide in general terms as follows: He who has invented a new and improved process or machine may, if he sees fit, retain within his own breast the knowledge of the thing, or if he constructs machinery for the purpose of illustrating his invention and puts it into use, or if he carries on the process which he has invented, he may choose to carry it on secretly, and if he is able to preserve the secret from the depredations of others, he may thus retain a perpetual monopoly—a perpetual, exclusive use of the invention—and may thus, as it were, perpetually levy tribute upon the public for the use of it. The provision of the law, however, is that if he will make public the machine or the process which he has invented, if he will put down upon paper a clear, distinct, and intelligible description of it, then the government will give him the exclusive right for a definite number of years (under the present condition of the law, for seventeen years) to use that improvement, the consideration for that grant being, of course, that he has made it known to the public, so that when the seventeen years shall have expired, the public will not only have the right, but they will also be able, to exercise this art for their own profit and advantage. So that you see on one side a special grant, made by the government to the inventor, that he shall have the exclusive use of his invention for a certain time, and there is, on the other hand, a consideration given for it by the inventor—that is to say, the disclosure of his invention, so that the public may afterward have the benefit of it. Now, this grant which is thus made to an inventor constitutes property to which he is entitled, and, as in the case of all other property, the law forbids any encroachment or infringement upon this right—that is to say, just as the law forbids any man to take and carry off the physical property, as the book, or the knife, or the tool, employed by another in his work, so it prohibits any person from using or practicing the invention in respect of which this patent has been issued; and in case any such infraction of the law should occur, the patentee has a right to bring his action against the person who has so interfered with his rights, and recover from him such reasonable damages or such other relief as the forms of law permit. He is allowed, and for a long number of years in the past he has been allowed, to bring his action either on the law side, as it is phrased, or on the equity side, of the court—that is to say, he may cause his dispute to be brought for determination before a jury, as in this case, or before the court, as in an equity case; and he is allowed free liberty of choice between these different remedies, choosing, of course, that one which, according to his judgment and the best advice that he can get, will be the most advantageous to him. If the patent has expired, as in this case, he is compelled by the law to bring his action before a jury, and the attitude in which he stands is this: He has no longer an exclusive right to this invention—that is to say, it is competent for any person in the community, notwithstanding the patent which we have here produced, at this present time, and to-day, to make the machine described in his patent. During the period of time, however, when the patent was in force, it was not lawful for any person to make such a machine. Therefore, if during that time, as is here alleged, the defendants have made a machine which contains the invention patented by him, supposing you find that to be a practical and valid invention, then his right now to recover such damages as he may have suffered is perfect and complete.

"The provision of law that no person shall take, or use, or infringe the rights of a patentee does not depend upon the knowledge on the part of the public of the patent itself—that is to say, an actual knowledge. The patent is public, and is accessible to any person who may conceive that his business interests will be subserved by his finding out what his rights are and what they are not; but whether he reads the patent or not, he is nevertheless bound by it. He cannot excuse himself by alleging, or by proving even, if he can prove it, that he was not aware of the rights of the patentee. A patentee's rights are derived from the grant of the government, and are complete from the time when the patent is sealed and delivered to him, and it is the business of every person in the community to avoid infringements, at his own risk. Nor is it necessary, gentlemen, before bringing the action that the patentee should notify or inform the defendant that he conceives there is an infringement of his patent.

"The plaintiff may produce his patent, which is the evidence of his right, and if he shows that it has in point of fact been infringed, then it will be no defense to his action if the defendant either prove that he did not know of the existence of the patent or that the plaintiff neglected to notify him. He was bound to know, and the plaintiff was not bound to assist his information or knowledge by notifying him."

The Future of Our Boys.

Mr. Noah Brooks, whom all boys will recognize as one of their best friends, and as one of the most interesting writers for the young people of this country, comments in a forcible way on a question of ever pressing importance in the current issue of the *Epoch*. It is, "What shall be done with our boys?" He finds the learned professions full, and many avenues of work either crowded or closed. The sea, which formerly gave occupation to thousands of brave American boys, is now sailed by vessels manned by foreigners. The employments once wholly filled by male youth are now largely occupied by women. These include clerical positions, private secretaryships, and the like. It is true that the new order of things makes competition sharper, and gives boys fewer chances; but this country is so large, and its interests and demands so multifarious, that there is always something for every one to do. It stands to reason that all boys cannot achieve wealth and fame; but as the years go, by the proportion of the fortunate ones will constantly grow larger. What is needed more than anything else to add to the usefulness and honor of coming generations is a higher and fuller appreciation of the dignity of labor.

We have in mind the experience of a Maryland boy who was left several thousand dollars by his father. He did not squander it, as many boys would have done, but he determined to spend it all, and he did it in such a way that it became the very best investment that he could have made. He went into one of the railway shops of the city at nominal wages, and paid the rest of his expenses out of his little fortune. He learned all he could in a practical way there, and then entered a first class school of technology. By the time he graduated his money was all gone, but he was able to earn his way. He kept on learning, and the consequence was that he soon rose to an excellent position, and to-day he is in receipt of a splendid salary, and is considered one of the best men in his profession in the country.

Mr. Roberts, the wonderfully able and astute president of the great Pennsylvania Railroad, started out as a chain carrier in a surveying party. Mr. Frank Thomson, the vice-president of the same road, was an apprentice in the Altoona shops. Mr. Samuel Spencer, of the B. & O., and one of the best railroad men in the country, was a clerk not many years ago at Camden Station. Instances innumerable could be cited, and the moral of them all would be to learn a trade, and to trust to industry and application for promotion. The future of our boys is the future of our country. We have not the slightest doubt that it will be brilliant and substantial; but the individual cases of marked success must always depend upon the capacity and industry of the individuals. Boys who look upon life as a serious problem, that must be worked out and not played out, are able to take care of themselves. The idlers, who expect to live on money which they do not earn, are the drones in the great national hive of industry.

Chrome Steel Projectiles.

The first lot of 12 inch chrome steel armor-piercing projectiles, manufactured by Messrs. Holtzer, have been received at Woolwich, and the trial took place on March 26, at Shoeburyness. The conditions of test upon which their acceptance depended, and which were much more severe than the specification of either the Russian or French governments for these shots, were more than complied with. Two selected projectiles were fired at 16 inch compound armor plates, manufactured by Sir John Brown & Co., Limited, and these passed through the targets, being found entire at the back. The plates were exceedingly good, being some of the hardest made by Messrs. Brown & Co., but the shells completely shattered them. This settles the question as to the value of these projectiles in the destruction of armor-plated vessels, since there is not an ironclad afloat which could not be riddled by these shots when once within range. As these are the first shots manufactured for the English government, we are glad of such a satisfactory result, and we understand that the whole lot were delivered at Woolwich in good condition without any cracks or damage.

Whatever soundness there may be in a somewhat widely accepted belief, in official circles, that our standard types of heavy shell are thoroughly efficient because they can destroy the unarmored portions of hostile ironclads, it is evident that in any future naval campaign we shall be opposed to ships furnished with true armor-piercing projectiles, and the Ordnance Committee have shown a wise appreciation of the necessities of the situation by commencing to provide for the supply of *materiel*, which every first class power, except ourselves, already possesses.—*Engineering*.

New Remedy for the Sleepless.

Now, what is it that disturbs sleep? Noise? Not altogether, for the inhabitants of besieged towns have been known to sleep through the roar of bombardment, and to waken suddenly when the firing ceased. Millers will sometimes start up from sleep, awakened by the mere stopping of the mill wheel. The rattle of a train in motion will induce sleep, as all travelers know. And last, not least, the sleep of infants, the sweetest and soundest sleep of all, is promoted by sound. The popular view, then, that noise disturbs sleep, like most popular views, only touches the truth, but does not grasp it. The true cause of disturbance is interruption. Any sudden cessation of the continuity of silence or of sound awakens the sleeper; for sound, provided it be monotonous, has precisely the same effect on the brain as silence. That simple piece of mechanism, the alarm clock, is based on the theory of interruption—it interrupts silence.

Now, might not, suggests the *English Medical Journal*, an equally simple contrivance be made on the same mechanical principles, but with the reverse object, viz., that of insuring sleep by sound? Its utility, to delicate persons especially, would be undoubted. Call it the morphiometer, the somniferant, or give it a French title, and christen it in the garde-somne, or sleep-preserver—a name, by the way, that would truly designate its object, for its real object would not be so much to promote sleep as to insure the sleeper against disturbance (and vulnerable side of light sleepers) by placing a bulwark of sound between him and the sudden shocks of extraneous noise. Let your sleep-preserver produce the drowsy, monotonous buzz of the humming top, not so loud as to be heard in an adjoining room, but loud enough to drown distinct noises when placed close to the bedside or hung over the pillow.

Polarization of Resistance Coils.

During the last twelve months several instances of this phenomenon have been chronicled, enough to make it probable that a large proportion of coils are thus affected. Prof. Mendenhall was one of the first to notice it. At the Buffalo meeting of the American Association, last fall, a paper was read on the subject by him. On discovering the fact that a deflection of the galvanometer might be produced by a coil directly connected thereto, and not in a battery circuit, the most natural conclusion was reached that it had become charged, and that its electrostatic discharge produced the effect. This was at once disproved by the fact that the current lasted for some time, in one instance for many hours. Electrolytic action was then suspected.

The coils were examined, and those which showed polarization most strongly proved to be most affected as regards their insulation. Some were baked at 150° C., when polarization disappeared, only to reappear when a drop of water was placed upon them. In another case, a coil which had been restored by baking again, showed polarization after ten days' standing. The suggestion is made either to fill the entire space in the box surrounding the coils with melted paraffine or to use a tight box filled with petroleum oil of proper quality. An important source of error is here pointed out, which all electricians should guard against.

Cataract Induced by the Vibrations of Tuning Forks.

Dr. S. Th. Stein, in order to examine the functions of the cochlea, acted on the eyes of very young porpoises, both in the unmutilated state and after the ears had been destroyed, by means of the vibrations of tuning forks of different pitches. Cataract was produced in both classes of experiments. In the entire animals continuous subjection to the action of a high-pitched tuning fork induced cataract in from eighteen to twenty-four hours, while a tuning fork vibrating 100 to the minute produced the same effect in twelve hours. In animals whose ears were destroyed, the cataract was much more quickly induced by the tuning fork, some two or three hours being then sufficient. Dr. Stein's theory is that the condition of the lens is affected by the giving off of heat from the body, and that this is altered by the vibrations, the perception of sound again tending to retard the development of cataract. The members of the Moscow Medical Congress, before whom Dr. Stein related his experiments, did not appear inclined to acept his theories, and Professor Khodin remarked that it was not an uncommon thing for young porpoises to be born with cataract. To this, however, Dr. Stein replied that the cataract produced by his tuning forks passed off after a time, and could then be reinduced by the same method.

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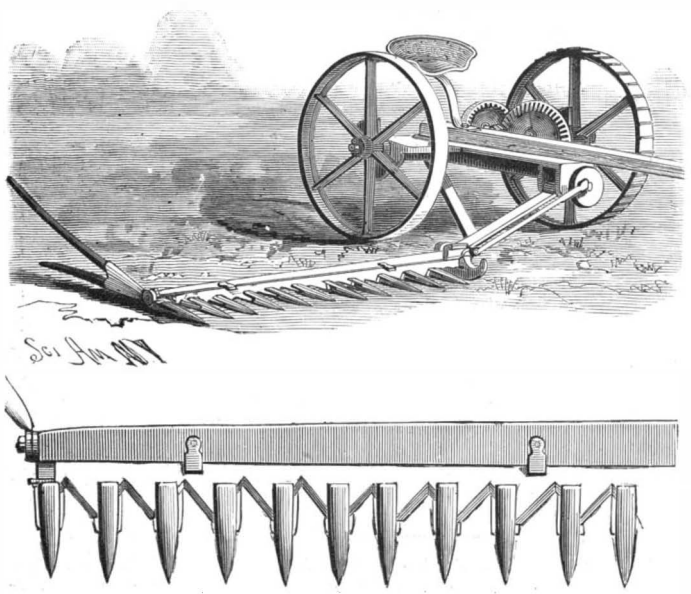
IMPROVED CUTTER BAR FOR MOWERS AND REAPERS.

The great advantage derived from the use of the improved cutter bar for mowers and reapers which is here illustrated is that it makes old machines run very much easier. The improvement is exceedingly simple, and the saving in power to be derived from its use is apparent. The middle or intermediate fingers of the guard are arranged somewhat closer to each other than the remaining ones on each side. The middle cutting teeth, or single tooth, where the fingers are of an odd instead of an even number, are made wider at their base ends than the others on each side. This arrangement virtually amounts to lengthening the cutter bar and shortening the finger bar at their centers. By this construction the cutting teeth throughout one-half of the length of the bar, when moving in either direction, are made to complete or nearly complete their cut before the teeth of the other half come into cutting position with the fingers, thus dividing up and easing the cut in both directions of the cutter bar's travel. This improvement has given great satisfaction wherever used, and even when applied to old and hard running machines has made them run easier than when new. It also does away with clogging.

This improvement is the invention of Mr. L. Rundell, of Grapeville, N. Y., who will furnish further particulars. It may be applied to any machine for five dollars.



RUNDELL'S IMPROVED CUTTER BAR FOR MOWERS AND REAPERS.

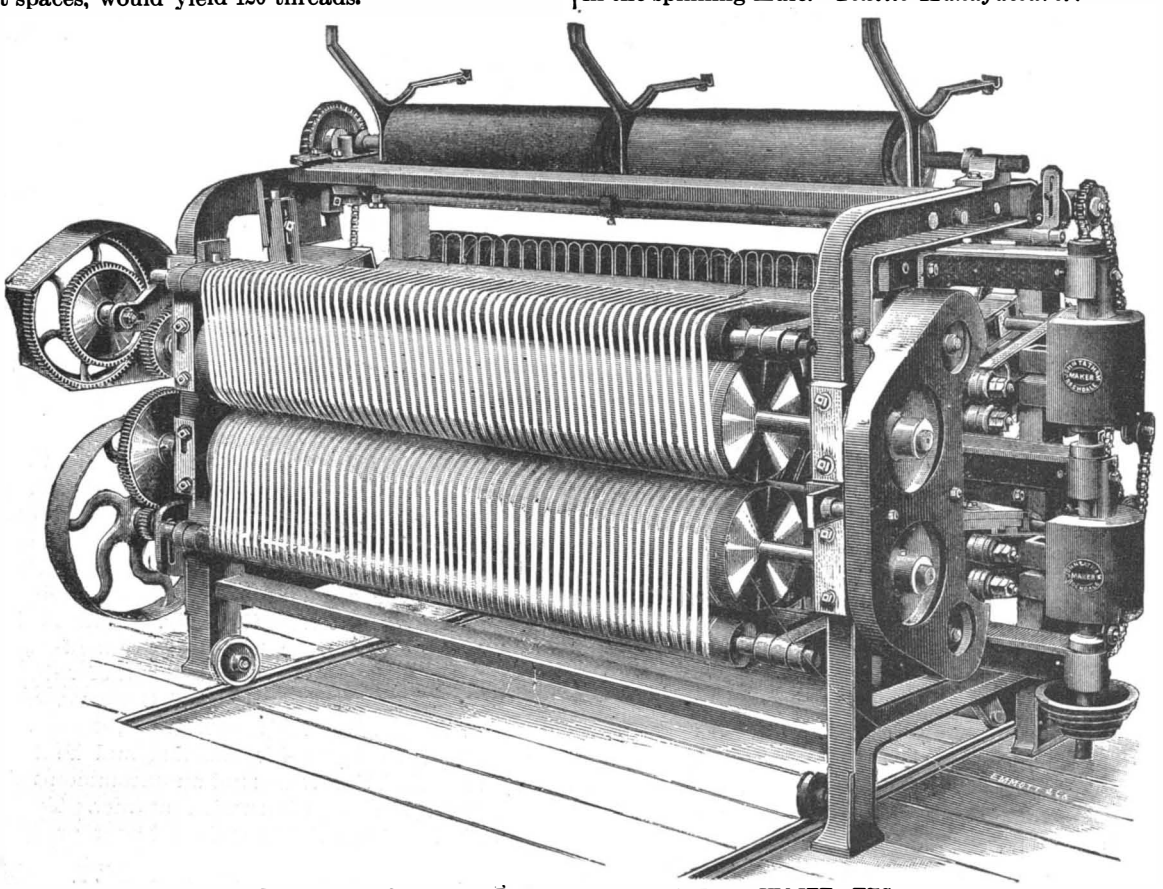
IMPROVED CONDENSER FOR WOOL, COTTON, COTTON WASTE, ETC.

The somewhat crude state of much of the woolen machinery still in use finds many exemplifications. It is well known that, in order to divide the sheet of carded wool into threads, a large amount of the surface of the doffer card is lost through the necessity of spacing it in order to effect the division. Hence the actual capability of the machine is reduced this much. A 60 in. doffer, through this necessity, can only, on the old plan, give about 60 threads, while the effective work it could do under ordinary circumstances, without spaces, would yield 120 threads.

The raw material is usually passed through three cards—the scribbler, the intermediate, and sometimes two finishers. These differ only in the details, consequent upon the treatment of a different fiber, from those of a cotton mill, and in this respect it is mostly in the methods of feeding and doffing that the variation is principally made. As observed above, it is in the doffer of the finisher card where the chief difference is made. By the alteration introduced here, the woolen and cotton waste trades are enabled to dispense with the drawing, slubbing, and intermediate roving frames, or any machine analogous thereto. In fact, drawing in the woolen manufacture is avoided wherever possible, and where not possible, is only carried to the extent necessary to secure the desired attenuation. Hence th requirement of doffing from the finisher card in the form of thin tapes of wool, which in the condenser, by the transverse action of the rubber leathers between which these tapes pass, are rolled or condensed—not twisted, because the action is a backward and forward movement—into threads, and wound upon the condenser bobbins, ready for the drawing or spinning mule, accordingly as they have to undergo further attenuation or be made into a finished thread at once.

The machine we illustrate herewith is a new condenser, which works equally wool, cotton and cotton waste, by Mr. John Tatham, of Rochdale, and which is a decided improvement upon the old form, as it economizes the capability of the card to its full extent by permitting the doffing cylinders to be covered throughout with an ordinary fillet card without spaces, as described above. Hence a 60 in. doffer is made to yield 120 good condenser threads, as against 60 on the old plan. This is accomplished by relieving the doffer of the duty of dividing the wool and carrying this a stage further into the condenser, where, by the introduction of a pair of rollers (shown in the front of our illustration), having their peripheries grooved into spaces of the desired sizes, and in which the projections of one roller fit into the corresponding grooves of the other, the whole space is utilized and the production doubled. These are termed tape rollers, because of the series of tapes with which they are furnished (as shown), and which carry the sheet of wool from the doffer cylinder, where it is divided into the required number of threads by the action of the grooved rollers, and thence delivered to be condensed in the ordinary way by the rubbers. This is the main feature of the improvement, the remainder of the condenser not having been materially altered.

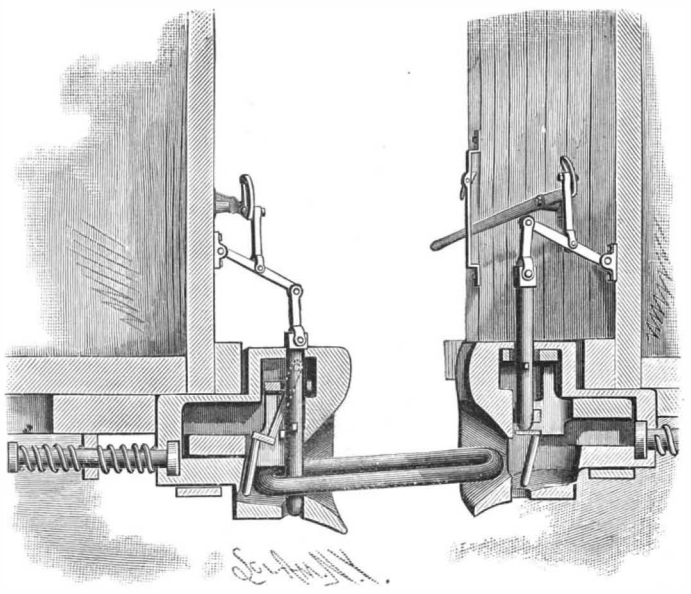
As compared with many condensers now in operation, the new one is a very substantially constructed and beautifully finished machine, with numerous improvements in details that need not be dwelt upon here, but which will at once strike the observer. The great fact to be dwelt upon is that the improvement increases considerably the production from the card, with the important results that this statement implies, and effects considerable saving in the subsequent operation in the spinning mule.—*Textile Manufacturer.*



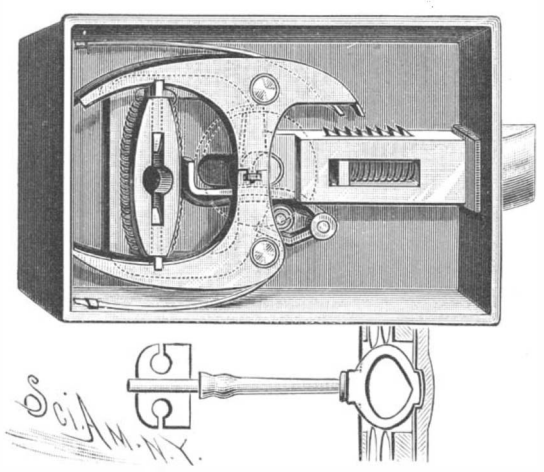
IMPROVED CONDENSER FOR WOOL, COTTON, WASTE, ETC.

THE KEYSTONE AUTOMATIC CAR COUPLER.

It is claimed that the car coupler herewith illustrated meets all the requirements of the convention held by the executive committee of the Master Car Builders Association at Buffalo in September, 1885—that it will couple with the standard link, and automatically with its own kind at a slow speed, and also when the cars are brought together sharply; and it can be set not to couple when the cars come sharply together. It will operate on a straight track or on a sharp curve, and will couple cars whether high or low. As the coupler can be operated from the side of the car by means of a lever, in uncoupling and also in setting the coupler to couple, there is no occasion for the brakeman to enter between the cars, and all danger of accident is thus avoided. The floor of the link recess slopes downward and backward, and when the link is inserted its outer end is raised in position to enter the opposite drawhead by a weight or dead block resting upon its inner end, as shown at the left in the engraving. To uncouple the cars, the latch of either car may be tripped from its lever, which will then fall to lift the coupling pin and dead block, leaving one end of the link free to allow the cars to be drawn apart. While the lever is in this position, the cars are drawn apart, and a gravity pawl swings forward under the lower end of the pin and holds it up. The outer end of the operating lever is lifted and held in its raised position by a latch; the coupler is then set to couple, and as soon as the entering link strikes the pawl, the latter is moved backward to allow the pin to drop through the link and couple the cars. In this coupler there are no springs or other delicate parts, and it is strong, reliable, and effective.



THE KEYSTONE AUTOMATIC CAR COUPLER.



ADAM'S COMBINED LATCH AND LOCK.

This invention has been patented by Messrs. N. T. Dundore, H. H. Sechrist, and I. M. Brubaker, of Dundore, Pa., to whom railroad companies, car builders, and others interested may apply for rights of manufacture and of use.

COMBINED LATCH AND LOCK.

The accompanying engraving represents a locking latch, the bolt of which may be fastened in an opened or closed position from the inside of the door, or left free to be operated by a key from the outside of the door. The stud of the knob of the lock passes through a slot in the face of the case, and carries at its inner end an arm which may be so set as to lock the bolt in its extended or withdrawn position; but when this arm is in a position at right angles to the bolt, the latter can then be operated from the outside of the door by means of a key. To increase the security of this latch, the key is formed at one end with nibs resembling those of an ordinary key, which will enter the lock, but will be unable to move the tumblers so as to permit of unlocking, while the opposite end is provided with a bow which will enter the lock, and will move the tum-

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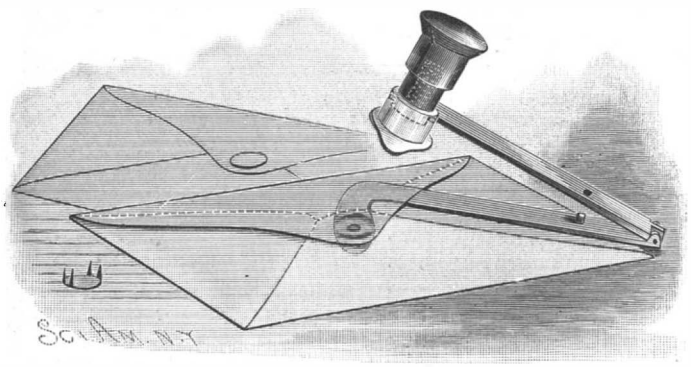
blers, so as to permit of unlocking by turning the key. The key is made in this form for the purpose of deceiving persons who are unauthorized to use it, the object being to convey the idea that the end of the key provided with nibs is to be employed for operating the lock, while it is impossible to operate it except with the bow end. When a key of this kind is lost, if the finder is disposed to attempt to use it he will naturally employ the nib end, and will be unlikely to try the opposite end. Should a key be inserted in the key nut, which will not move the tumblers sufficiently to release the levers, the key nut cannot be turned, and should a key having too great width be inserted in the nut, levers will be moved so far as to bring properly arranged pawls into engagement with a rack bar formed on the bolt, which will thus be locked, so that it cannot be withdrawn, even though the key nut be released.

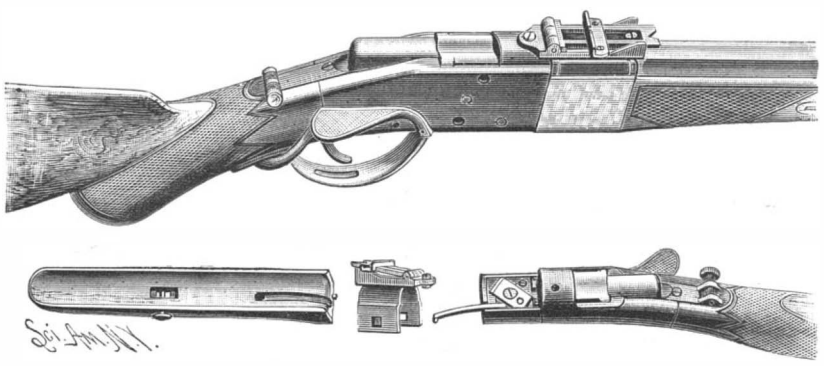


EDER'S DEVICE FOR SECURING ENVELOPES, ETC.

This invention has been patented by Mr. William C. Adam, 867 Washington Street, Buffalo, N. Y., who will sell the patent or receive offers to manufacture on royalty.

IMPROVED FIREARM.

Mr. Salvatore J. Buzzini, of 500 West 125th Street, New York City, has recently patented an improved firearm, which we herewith illustrate. By means of this invention the barrel of the firearm may be readily attached and detached, or replaced by another when necessary without having recourse to a gunsmith or other skilled artisan, which will be found a great convenience to sportsmen and others. It also provides for a more accurate return of the barrel to its normal position than is practicable when the barrel is secured by screwing it into the stock of the gun, and it also provides for the ready dismemberment and securing of the forearm and stock, as well as the barrel. The upper engraving shows the parts assembled and the lower one shows the parts separated, with the barrel removed. The rear end of the barrel is provided with flanges, and lies within the half socket portion of the stock, and may be provided with a rear smooth extension, arranged to fit within a smooth socket of the stock. This construction differs essentially from a screw-threaded fit. The barrel is held firmly at its rear end, and secured from forward or longitudinal movement by a locking cap, which is removably held in place. The top of the cap forms the base piece of the hinged and adjustable sight.



BUZZINI'S IMPROVED FIREARM.

This firearm is also provided with a lever for opening and closing the breech, and which serves as a trigger guard. The lever not only ejects the exploded shell, but cocks the arm, and the same motion automatically moves a safety catch which locks the trigger, thereby preventing accidental discharge. The arm cannot be discharged except by intentionally releasing the catch and pulling the trigger. In order to permit rapid firing, there is an adjustable device controlling the safety catch, so that the closing of the breech lever automatically releases the catch from the trigger. When rapid firing is not needed, the adjustable device can be set so as not to release the catch.

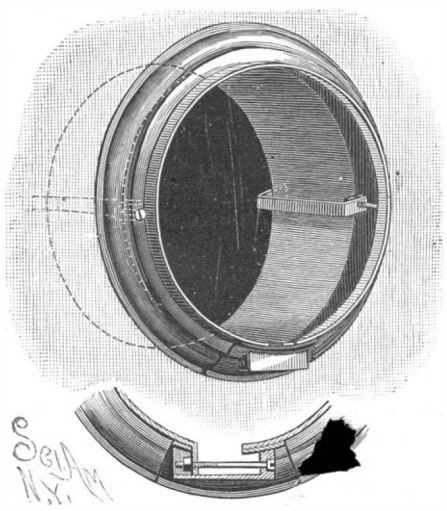
DEVICE FOR SECURING ENVELOPES, ETC.

The simple device which the accompanying engraving illustrates is designed for securing or sealing envelopes, binding bills or statements, etc. The device consists of two flat bars bent to the shape shown, and hinged together at the ends of their long arms. Near the end of one short arm a concavity is formed, over which rests, when the bars are closed, a tubular section secured to the other short arm, which is formed with an aperture the same size as the tube. Fitted to slide in the tube is a follower, which is normally pressed upward by a spring. To use the device for sealing an envelope, the flat arm is inserted in the envelope, between the back and contents, when the flap is then folded down. In the tube is placed a disk of thin sheet brass or other suitable metal formed with sharp spurs bent at right angles to the disk. This arm of the device is then turned so that the spurs rest upon the envelope flap, when the follower is struck a light blow with the hand, driving the spurs through the flap and back of the envelope. The spurs strike the concavity and are turned inward toward the center of the disk, so as to fasten the two sheets of paper securely together. By turning the arm as it is drawn out, it may be removed from the envelope without danger of tearing the paper. It is evident that sheets of paper of any description may be fastened together in the same way. If desirable, the disks may be stamped with a trade mark, firm name, or suitable device.

This invention has been patented by Mr. James M. Eder, of 27 Holborn Viaduct, London, England.

IMPROVED STOVE PIPE COLLAR.

The object of this invention is to provide a simple and efficient device for clamping a stove pipe, and holding it in its position in the flue. The collar is of the usual form, and is divided at one side by cutting out a segment. This opening is covered by a segmental plate, of the same form in cross section as the collar, and which overlaps the ends of the collar. The plate is secured to one end of the collar so as to slide over the opposite end. Upon the face of the plate is formed a projecting chamber, open on its upper side and at one end, and from the free end of the collar an ear projects into the chamber. A bolt passes through an opening into the chamber, through an opening in the ear, and receives a nut beyond the ear, so that, by turning the bolt, the collar may be contracted or expanded as required, as will be understood from the lower figure in the annexed cut. The collar is held in place on the flue by C-shaped straps, the long arms of which are inserted behind the wall of the flue and the short arms are apertured to receive bolts which pass through the front of the collar, through the short arms and into nuts behind the arms. The divided collar is placed against the wall of the flue, the angled plates are inserted and their bolts are tightened sufficiently to hold the collar in place. The stove pipe is then passed through the collar and into the flue, when the collar is contracted around the pipe by turning its bolt until the pipe is clamped tightly in the collar. The bolts in the angled plates are then further tightened to draw the collar closely against the face of the flue, and thus hold the pipe firmly in place.

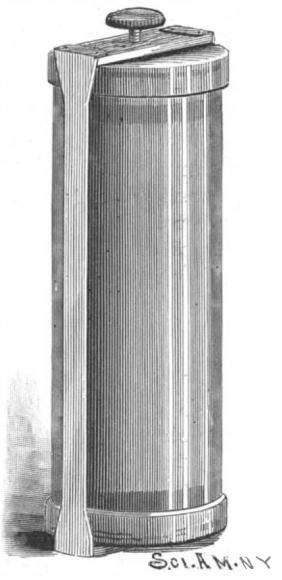


MATHER'S IMPROVED STOVE PIPE COLLAR.

This invention has been patented by Mr. Edgar Mather, of Matherton, Mich.

IMPROVED BUTTER JAR.

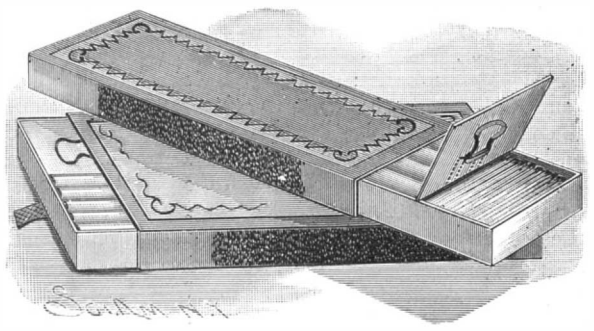
This butter jar consists mainly of a cylinder made of glass and two end caps or covers which are fitted to the outside of the tube and are adapted to press on packing placed at the ends of the tube to make air tight joints. The clamp frame consists of top and bottom cross pieces and side pieces, and is made to receive the cylinder with its caps on. In the top cross piece is fitted a screw, which may be screwed down hard upon the cap, to press together both caps, and draw their packings tightly to the ends of the tube. The clamp frame may be made of any material having the requisite strength. As here illustrated, the top and bottom pieces are made of wood and the side pieces of a metal strap in one piece, bent under the bottom piece and fastened at its ends to the top piece. Within the tube are placed one or two plungers, the inner faces of which, next the butter, may be formed with any desired design to imprint the butter as or before it is removed for use. It is obvious that when the clamp frame is removed, either of the plungers may be pressed against to force the butter from the opposite end of the tube in any desired quantity, and the butter projecting from the tube will have smooth, true sides, and may be cut off easily by a knife passed closely to the end of the tube. Butter not used may be returned to the tube. The tubes may be made of any desirable shape in section, and of such size as to hold a given quantity, thus obviating the necessity of weighing the butter when selling it. The name of the producer of the butter may be marked upon the tube. This jar makes a convenient package to handle, allows the butter to be cooled, by putting it in cold water or ice, and the butter in it remains sweet and fresh for a long time.



This invention has been patented by Mr. H. E. Hinman, of Ravenna, Ohio.

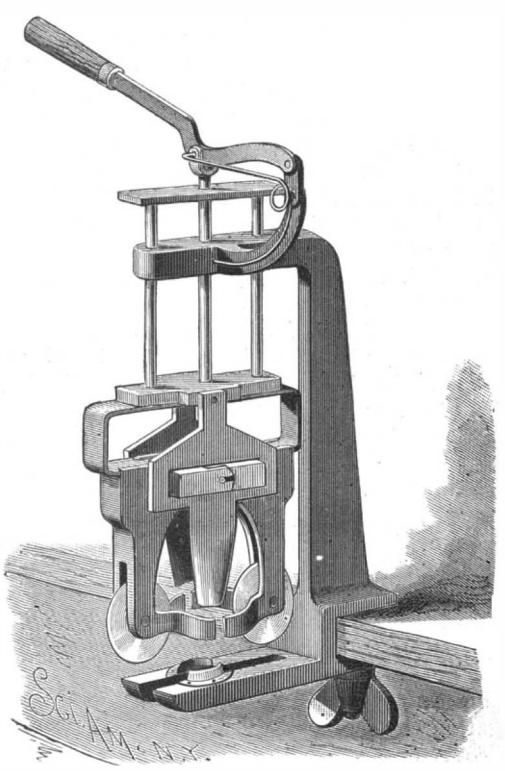
COMBINED CIGARETTE AND MATCH BOX.

At one end of the interior box, which is adapted to slide in a casing of the usual form, is a transverse partition, having an upper integral portion, which may be bent over to form a lid for the end compartment, which is designed to hold matches. The other compartment is purposed to hold cigarettes. As the inner box is drawn out, by means of a piece of tape attached to its bottom, the lid of the match compartment is opened by a simply arranged rubber band. The interior box can be pushed or, preferably, drawn into the casing by grasping the opposite end of the tape. The upper box shown in the engraving is designed to hold ten cigarettes, while the lower one holds twenty, and is provided with a compartment for matches at each end.



SAVAGE'S COMBINED CIGARETTE AND MATCH BOX.

This convenient article for smokers' use is the invention of Mr. Reavel Savage, of 47 Lexington Street, Baltimore, Md.



SMITH'S IMPROVED PEACH STONER.

[FOR DESCRIPTION SEE PAGE 276.]

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THE FIRST AMERICAN TYPE WRITER.

(*Continued from first page.*)

cleaned, the broken parts were replaced, and it was restored, substantially, to its original condition. The idea in doing this was to enable the public to see the first type writing machine ever invented or made in this country, upward of forty years ago, by a respected citizen of Worcester.

The restorations were carried out so as to reproduce essentially the missing parts. Some minor variations were admitted, however. Thus in the original machine the keys were of bone, slightly cupped, with letters in relief, so that the blind could use it. These were found to be nearly all destroyed, and in the restoration were replaced by disks bearing printed letters. We are indebted for the foregoing particulars to Mr. H. R. Cummings, of the Worcester *Spy*, and representative of the Standard Remington Type Writer Company.

The construction and operation of the machine are clearly shown in the cut. The type are attached to the bottom of a series of rods, which can be pressed vertically down by the finger, a spring forcing them up again when the pressure is released. These rods are carried by a horizontal wheel, and are arranged around its periphery. By rotating the wheel, any desired type can be brought to the front. There a stationary guide is placed to direct the type which is making an impression. An inking roller, seen on the right hand, inks the faces of the letters.

Arranged in the front of the type wheel is a roller, to which the sheet of paper is attached by clips to it. This Thurber machine was the first one embodying a roller for the paper. Finger pawls working into ratchets at the ends of the drum serve to rotate it after each line was printed. By means of a handle, which is seen projecting from the right side of the frame, the drum is shifted longitudinally on its axis rod, after a letter has been printed. Both of these operations were executed by the operator separately. But the essential mechanism for printing successive lines was for the first time realized in this machine, namely, a paper-carrying roller, which rotated to give the line spaces, and which also moved longitudinally to give the letter spaces.

The operation of the machine was extremely slow, and was as follows: The paper was secured to the drum, and was brought into the proper place under the type-bar guide. The type wheel was revolved until the desired letter came over the guide. The key was then forced down with the finger, and the character was printed. A key was then pressed which shifted the roller longitudinally to the distance of one letter. The type wheel was then turned, and the next type was brought in place and was printed. When the line was completed, another key was pressed and the paper roller was rotated on its axis to the distance required for a new line of printing, which was then proceeded with as described.

We have alluded to the paper-carrying roller as constituting one of its most interesting features. This roller, combined with the "basket" of pivoted type keys of the Beach machine, by which rapid printing is done, constitute the two leading elements of the fast type writers of to-day.

IMPROVED ORE CRUSHER AND AMALGAMATOR.

The engraving illustrates a new machine which has been made by the Reading Iron Works Company, England, and described by the *Engineer* as follows: The machine consists of an inverted cylinder 8¾ inches diameter and 9 inches stroke, attached to a cast iron standard, and having something of the appearance of an ordinary steam hammer. To the piston rod is attached a steel head, which crushes the ore between it and the anvil beneath. The steel head and anvil are inclosed within a cast iron box or "mortar," which is provided with three mouths, within which are fixed steel grids arranged either vertically or adjustable to the angle most suitable for the ore to be treated. In front of these grids is a wrought iron removable plate, which confines the pulp that splashes through the grid when the machine is at work. Water pipes are so arranged that jets of water are directed upon the quicksilver baths and grids and interior of the mortar. The hammer or stamp is raised by the action of steam beneath the piston, which compresses the air contained in the upper part of the cylinder, the ingress and egress of the air being controlled by suitable valves. The stamp falls with a force due to its weight plus the pressure of the compressed air above the piston. Steam is admitted to the cylinder by a slide valve and sliding plate of special construction, the latter being moved by a small auxiliary cylinder, which governs the admission of steam beneath the piston, and allows for variation in the thickness of ore in the mortar. The slide valve is moved by an arrangement of levers and link attached to a prolongation of the piston rod, which works through the top cover of the cylinder. The hammer or stamp is therefore raised by steam alone, without the tappets, cams, or other arrangements used in stamps of ordinary construction, and friction is thereby reduced. The ore to be crushed, being first broken to pass through a 1¼ inch mesh, is raised by an elevator, consisting of cups fixed to an endless chain passing over a suitable wheel worked by means of friction pawls. These are actuated by a lever, which in its turn is moved by a stud upon the prolongation of the piston rod. In a report on the machine, Mr. Barnes Kinsey, M. Inst. C. E., says: "The machine was driven during my inspection by a patent nozzle vertical boiler of 10 horse power nominal, manufactured by the Reading Iron Works, and is well suited for the purpose. Indicator diagrams taken gave 7·57 as the indicated horse power. The quantity of ore crushed was at the rate of 12 cwt. per hour, equal to 14 tons per day. This result was obtained with grids having a mesh of 64 holes per square inch, and I estimate that had the grids been the ordinary mesh of 90 holes per square inch, the duty would have been equal to that of a 10 head cam stamp mill, which requires 10 horse power nominal to drive it, and will theoretically crush 10 tons per day; but being liable to clog, owing to the irregularity of feed in machines of the cam type, the blow of stamper and consequent useful effect are reduced. This cannot take place with Williams' patent stamp, the rapidity of the blow causing the water to act upon the ore in a much shorter time and thus assisting disintegration, which in the cam stamp is retarded through the stamper resting for a longer period upon the stuff. The large size of the mortar in the Williams stamp, combined with the arrangement of the anvil face below the water line, is very effective. A splash is produced each time the stamper falls, driving the crushed ore or pulp against the grids and at the same time cleaning them, and as the angle of the grids can be adjusted to the material under treatment, an excellent result can be obtained. The whole of the mortar can be cleaned in fifteen minutes. An effective arrangement has been devised by means of a tray fixed on the top of a mortar beneath the steam cylinder, for collecting any oil or grease that may run down from the moving parts or cylinder, and preventing it getting into the mortar. The wear of the anvil and stamp head is considerably less than in cam machines, and is allowed for by a screw adjustment by which the cylinder and stamper can be lowered in a few minutes. The weight of the machine is 4½ tons, as compared with about 12 tons average weight of a ten stamp mill with iron frame of ordinary pattern. The ore pulp is delivered on to three tables, which are covered with amalgamated plating; and either of them may be thrown out of use by sluice plates, and thus enable it to be cleaned without stopping the machine. Ripples are provided for collecting the mercury. The tables deliver the pulp to a patent agitator amalgamator, which consists of two parts. The first is a horizontal tapering cylinder or drum, having ripples formed within it for the reception of mercury and plating. It revolves slowly on the edge of amalgamator No. 2, which is kept in motion by a spur gear and chain worked from the automatic feed gear of the stamp. Amalgamator No. 2 is in the shape of a crinoline revolving on a vertical shaft. The top is formed into a pan about 3 feet diameter and 3 inches deep, for the reception of mercury. The sides hang down about 3 feet, and are formed with small channels for mercury, the spaces between them being filled in with amalgamated plating. The whole rests upon an iron pan, which also serves as a foundation plate. On the top of the vertical shaft is a receiver for exhaust steam, which is distributed through a series of removable pipes on to the surface of the mercury contained in the top pan. This is kept in a constant state of ebullition by the steam, enabling the mercury to come in contact with every part of the pulp, this important point being greatly facilitated by the warmth produced. The ends of the distributing pipes are fitted with copper nozzles to act as collectors, and there are also a number of hollow amalgamated copper balls which float in the top pan and act in a similar manner."

Why do not the Gastric Juices Destroy the Stomach?

Why the walls of the stomach and intestine are not themselves digested by their own fluids has for more than a hundred years been a mooted question in physiology. John Hunter, in a paper read before the Royal Society in 1772, maintained that it was because these tissues were living, or, as he expressed it, "animals, or parts of animals, possessed of the living principle, when taken into the stomach, are not in the least affected by the powers of that viscus so long as the animal principle remains. Hence it is that we find animals of various kinds living in the stomach, or even hatched and bred there, yet the moment that any of those lose the living principle, they become subject to the digestive powers of the stomach." Other theories have been advanced to explain the facts in the case, but all are unsatisfactory.

Dr. J. W. Warren contributies an article to the *Boston Medical and Surgical Journal*, in which he reviews the evidence presented by those who have maintained these several theories, and gives the results of some twenty experiments of his own, made on fifty frogs. He suspended the legs of the frogs while living in an artificial gastric juice (that is, pepsin and hydrochloric acid), and found that the muscular tissue was digested, as was shown by the presence of peptone, the frog remaining alive throughout the experiment. When acid alone was used without the pepsin, the muscle was softened and dissolved, but not peptonized, and therefore not digested. It thus appears that living tissues may be digested, and that the problem is as far from solution as ever. Dr. Warren comes to the same conclusion, but promises to investigate the subject more fully in the future.—*Science.*

IMPROVED PEACH STONER.

The accompanying engraving represents an improved peach stoner, that will cut and stone from three and a half to four bushels of clingstone peaches per hour. The cast iron supporting frame is secured by a clamping screw to the edge of a table. The upper part of the frame is formed with an extension, having vertical bearings for central and side rods which are connected together by upper and lower cross pieces. This arrangement of the rods prevents any side movement, and causes the knives to descend perfectly true and straight. To the upper end of the central rod is pivoted the operating handle, which is pressed upward by a spring arranged as shown. To the lower end of the rod is secured a flat steel spring, which is bent at right angles at its corners, and carries at its lower ends jaws whose meeting upper edges are formed with recesses, and with tongues fitting and sliding in the recesses. These tongues serve to prevent side movement of either jaw, as the jaws are moved apart when their cutters pass around the peach stone. In the lower forked free ends of the jaws are journaled circular revolving cutters, the edges of which are beveled and sharpened to adapt them to cut the peaches in halves. To the jaws, on each side of the cutters, are secured curved knives. To the lower cross bar are secured the upper ends of side knife supports, which are provided at their lower ends with auxiliary knives, which extend down on each side of the jaws, and are formed with curved cutting edges. The frame has a laterally extended shelf, having a slot formed through it, and on opposite sides of the slot are placed curved knives.

In operation, the peach is placed upon the curved knives carried by the shelf, and which cut into the lower side of the peach until they strike the stone. At the same time the handle is depressed, when the circular knives cut into the peach and strike the stone on its flat sides and at the stem end, the peach having been set so as to receive the cutters in that position. When the circular cutters meet with the resistance of the stone, they travel around the stone, the spring admitting of this movement, and carry the curved knives with them at equal distances from the stone, the peach being thus divided and cut away from the stone except a small strip at the sharp edges of the stone, which is cut away by the auxiliary spring knives, which are made of spring steel, to permit them to follow the curvature of the stone. The halves of the peach fall into a box placed to receive them, and the stone passes up between the jaws and is pushed up and out by the next stone. It will be seen that this machine is strong and simple in construction and well adapted for the work.

This invention has been patented by Mr. J. H. Smith, of Little Rock, Ark.

The Projection of Para- and Dia-magnetic Movements of Liquids.

A. Ricco, in *L'Elettricita*, gives the following simple method of illustrating the different effects produced upon para- and dia-magnetic liquids by the electromagnet. Collecting, by means of a convex lens, the rays from a candle, he reflects them from the level and plane surface of the liquid before the current is passed around the magnet. An image of the flame is thus projected, and is received upon a white screen. The current is then turned on. If the liquid is neutral or "amagnetic," no effect is produed; otherwise the image is scattered and confused. If the liquid is paramagnetic, the image can be caused to reappear by bringing the light or the screen nearer to the liquid surface, or by taking away the lens. The new image will be drawn out, indicating the formation of a cylindrical reflecting surface composed of the liquid itself. If the liquid is diamagnetic to cause the image of the flame to reappear, the flame or the screen must be withdrawn to a greater distance, or a lens of shorter focus must be substituted, thus proving the convexity of the surface.

How to Cure Warts.

Place the thumb upon the wart, and press it against the bone. Move the wart back and forth upon the bone until the roots become irritated or sore, when the wart will disappear. I have had quite a number upon my hands, and have got rid of all of them in the above manner.

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Correspondence.

The Spiral Fracture of Tubes—Another Instance.

To the Editor of the Scientific American:

The account of the breaking of a glass tube so as to form a spiral, given in your issue of this date, calls to mind a similar experience of our own which may prove of interest in this connection. We had several years ago a test tube break in the laboratory, in precisely the same way, while being cleaned. It formed a spiral spring, which had considerable elasticity. The width of the spiral band was about the same throughout as in the cut you show. We had no reason to think that the tube had been in any way cut or scratched. GRIFFIN & LITTLE.

Boston, April 9, 1887.

Exposure not Conducive to Health.

To the Editor of the Scientific American:

A writer in your paper of the 9th inst. advances the theory that the exposures of army life are conducive to health. An experience of five years leads me to differ with him. Before the war I spent a year on the plains, and during the service I spent three years in the Northern army. Later I spent another year camping out, and in all that time I have never known a man benefited by exposures such as your correspondent mentions, viz., sleeping in wet clothing, in the rain, or on the frozen ground. Now, the facts in the case are that plenty of physical exercise in the open air, with coarse, plain food, and not too much of it, is healthful, and a man endures the exposures because he has strength. He keeps well because he has a reserve force of vitality. This is shown when the exposure is too long continued and the man breaks down. Then the illness will be of great severity, often lasting a lifetime. I knew a young man in the army who, for a year, was never sick a day and was the picture of manly vigor. Three days of constant exposure broke him down, and though he is still living, he has never been a well man since. Fresh air, plain food, plenty of exercise—these are God's own appointed paths to good health. X.

St. Augustine, Fla., April 9, 1887.

A Destroyer of "the Odor of Dampness" Wanted.

To the Editor of the Scientific American:

Interested in management of a large hotel at the sea shore, we find great difficulty in keeping mattresses free from a musty odor, which soon comes into them from the damp atmosphere. The best of hair beds, in a few months, become affected by it, and after a year or two of use, so strongly as to be "most unpleasant." Is there any preventive or antidote? Disinfectants there are, but the rule with them is that most whole-witted people prefer the odor they displace to the stench they themselves create. And besides, an atmosphere laden with disinfectant is not ouly grevious in itself, but its horrible suggestiveness makes it a burden in waking hours, and brings nightmare to those which should procure us sleep, "sweet labor's bath." The present tenant of the "disinfected" room I know by his vileness, which "earmarks" him forever, but what do I know of his predecessor, whom this one was introduced expressly to expel? Was it bugs in the bed, or infection of disease in the circumambient air? The one villain is here, I know, but a dreaded unknown one may also be lurking round, and I cannot discover him because the later pest outsmells him.

Is there anything inodorous which is, at the same time, efficient to destroy the musty smell which will come into beds and carpets at the sea shore, and I suppose wherever there is damp atmosphere?. Sun and air are good, but very slow, and when the quantity is great, the labor necessary makes that means impracticable.

We will be much obliged for any suggestions, as soon as may be convenient. M. K.

Philadelphia, Pa.

Manganese Steel.

Pfeil & Co., London, are making bolts and nuts, bars and plates, and various articles, from an extremely tough soft manganese steel, which is made under their own immediate supervision. In their large stocks of engineers' requirements, Messrs. Pfeil & Co. are no longer keeping iron bolts, studs, and nuts. All are replaced by these very mild steel bolts and nuts, and nearly all the engineering establishments of note, as well as our government works, are using these bolts and nuts and steel. *The Engineer* says: We recently tested a number of these bolts by very rough and very severe trials, in order to satisfy ourselves that these bolts were really strong as against the very heavy stresses and strains to which they are sometimes subject in practice, and to see whether the steel of which they are made would withstand bending, hammering close, and severe testing by hammering in various ways, or whether the steel would only withstand heavy stresses slowly applied. The steel proved, however, to be of the very toughest kind, for it would withstand being nicked and bent round away from or closed up at the nick. Bolts up to ⅝ in. were tested by holding the nut fast in a vise, and then hammering the bolt until it was bent down at the screwed part through an angle of 130 deg., and then taken out and doubled down, and closed up with a heavy hammer on an anvil. The screw threads were thus jammed up and compressed upon each other on the inside of the bend, and opened out to double their pitch on the outside. Still the steel did not break.

The material is being used for piston and other rods, and in slabs for forging and welding into screw propellers for torpedo boats. It has also been tested for shields and armor plate purposes by the Woolwich authorities, with results that show that its toughness and general behavior are uniform. The following table is from a report on tensile tests of three pieces of manganese steel round bar, by Professor Alex. B. W. Kennedy. In each case the "remarks" are, "finely granular in center, edges silky."

Dimensions.			Limits of elasticity.		Breaking Load.		Ratio of limit to break	Extension on whole length of 10 in.	Reduction of area at fracture.
Breadth Ins.	Thickness Ins.	Area. Sq.in.	Lbs. Per s	Tons. q. in.	Lbs. Per s	Tons. q. in.		Per	Cent.
1·054 in. diameter.		0·873	43,460	19·40	65,760	29·35	0·661	25·7	55·0
1¾ in. diameter bar									
1·055 in. diameter.		0·874	38,580	17·22	64,510	28·80	0 598	27·8	54·5
1⅛ in. diameter.									
0·849 in. diameter.		0·566	43,890	19·60	62,700	27·99	0·700	23·7	57·1
1¼ in. diameter.									

From this table it will be seen that steel combines toughness and elastic strength in a most remarkable degree.

Some tests were also made with hooks forged of S. C. Crown iron and this manganese steel, with the result that the iron hooks opened out equally with a pull up to 8 tons. With load in excess of this the iron hook opened faster than the steel hook, and ceased to hold as a hook with 11·7 tons. The steel hook was still serviceable, and showed no signs of distress.

News, Facts, and Prophecies.

Public Opinion, published in Washington City, has compiled from various sources the following items of interest:

There are forty-seven vessels under construction at lake ports, which will cost $6,440,000. This extraordinary activity in preparing for the summer water traffic between the West and the seaboard is encouraged in part by the average profit of 25 per cent earned last year by the lake carriers, but mainly, no doubt, by the expectation of large additional water traffic to be driven from the railroads by the operations of the inter-state commerce law.

Cast steel driving boxes will never run against cast iron wheel hubs, and the sooner trying to make them is abandoned, the nearer will be the day when delays due to hot boxes are no longer to be feared. Either the wheel hubs or boxes must be lined with brass or its equivalent.

It is reported that a syndicate of Belgian and English financiers have offered the Chinese government a loan of £32,000,000, repayable in ten years, for the construction of 1,500 miles of railroad, partly from Nanking to Pekin and partly from Canton.

The purchases of pine lands in northern and central Louisiana still continues. A single firm, representing leading lumber interests in Grand Rapids, Michigan, has just bought 30,000 acres more of government pine land in Natchitoches parish, making its total holdings there 290,000 acres, all bought within the last two years.

In the extreme southwest corner of Louisiana lies what is claimed to be the largest producing farm in the world. It contains 1,500,000 acres of land, and is operated by a syndicate of Northern capitalists. All the cultivating, ditching, etc., is done by steam power. The Southern Pacific Railroad runs for thirty-six miles through the farm. Three steamboats are running on the waters of the same estate; also an ice house, bank, shipyard, and rice mill belong to the same.

The price of some of the largest locomotives used on the English railways is at present about £2,000 each.

The mining industry of the United States to-day owes its present promising condition, its general activity, the favorable state of public opinion, the investment of capital, and the wonderful development everywhere witnessed more to the influence of the press than to any one or all other influences combined, but its return for all this benefit has, as a rule, been most niggardly and certainly unjust.

In view of the fact that the work of opening and developing a mining property is costly, and requires, usually, an extensive outlay of capital, often with uncertain results, shows the necessity of a better adjustment of the relative price of a mere claim and a mine worthy of the name.

Mayor Hewitt has been petitioned to establish scales at convenient points in the city, where all coal shall be weighed.

The Boston *Journal* says that the record of business misfortunes for the first quarter of the present year is by no means a short one, the number being 3,128 in the United States. Last year the number during the corresponding quarter was 3,362, but in 1885 the number was 4,050. In the active year of 1880 the number of failures the first quarter was only 1,394. The larger part of these failures are for small amounts, and are due to overtrading, to the folly of four parties entering into trade in a place where there was a field for but two.

The Pittsburg *Commercial Gazette* thinks that strengthening the position of the railroads everywhere at the temporary cost of commerce may lead to building new lines and extending others, but the Canadians, by reducing tolls on their canals and cutting prices on their railroads, will do something toward attracting to their territory considerable transportation which would otherwise go by American routes. They cannot affect seriously the great volume of trade in this country, but they will be stronger competitors than heretofore against our trunk lines.

It is astonishing, but indisputable, that there are towns of 15,000 inhabitants west of the Missouri River in which real estate is daily changing hands at higher prices than similar property brings in St. Louis. We may say that this is illogical and unhealthy, but the fact remains that such trades are being made, and that the boom constantly gains in energy and dimensions. —*St. Louis Globe-Democrat.*

The Edison Company have closed a contract for electric lighting in Tokio, Japan. The central station will supply several thousand lights, a large number of which will be used in the Mikado's palace.

Mr. Daniel Davis, who died recently at Princeton, Mass., made much of the earliest telegraph apparatus for Morse, and in his shop also, it may be noted, was made by Elias Howe one of the earliest sewing machines. He will, however, be best remembered through his work on magnetism, entitled, "A Manual of Magnetism, including Galvanism, Magnetism, Electro-Magnetism, Electro-Dynamics, Magneto-Electricity, and Thermo-Electricity."

Some observations made in France by M. Cosson may throw light upon many mysterious fires. In one instance spontaneous firing arose from an air current heated to seventy-seven degrees Fahrenheit only. The wood slowly carbonized at that temperature, and, being thus rendered extremely porous, a rapid absorption of oxygen resulted, and sufficient heat can then be produced to inflame the dry material. In another case the warmth from the air-hole of a stove was sufficient to set fire to woodwork.

A syndicate of Minneapolis capitalists have formed a company to put into practical operation a patent that promises to revolutionize the system of smelting and refining the precious metals, gold and silver. The patent was devised by John A. Potter, of the Union Steel Works, of Chicago.

Prof. C. V. Riley, the entomologist of the United States agricultural department, has gone to California to investigate various matters which have been demanding the attention of his bureau for some time. His special mission is to investigate the Coltony cushion scale, an insect imported from Australia, which is doing immense damage to the citrous orchards of California.

The second spring meeting of the Indiana Academy of Sciences will be held on May 19 and 20, 1887, at the "Shades of Death," near Waveland, Montgomery County, Ind. This place is situated on the banks of Sugar Creek, which here passes through a deep gorge cut in the sub-carboniferous sandstone.

The marine laboratory of the Johns Hopkins University has been opened at Nassau, New Providence, West Indies, under the direction of Dr. W. K. Brooks.

A halibut weighing thirty-four pounds and measuring 41 inches in length was captured recently in the lower Potomac, near Colonial Beach. This is the first authentic case of a halibut in fresh water. Hitherto it was supposed that the vicinity of Long Island was the extreme southern limit of the habitat of this fish.

The J. B. Lippincott Company have become the publishers of *The American Naturalist*, which will be continued under the editorial management of Prof. E. D. Cope and J. S. Kingsley.

Heavy machinery is now run by artesian well power in many parts of France, and the experience of the French show that the deeper the well, the greater the pressure and the higher the temperature. At Grenelle a well sunk to the depth of 1,802 feet, and flowing daily 500,000 gallons, has a pressure of sixty pounds to the square inch, and the water from this well is so hot that it is used for heating the hospitals in the vicinity.

The failure of Congress to provide for sheathing with copper the new steel vessels authorized to be built for the navy will result in the raising of a great crop of barnacles on the hulls of the gunboats and cruisers. Several thousand dollars have been expended in experiments during the last two years, but up to this time no method of protecting vessels from fouling has been discovered equal in efficiency to the old system of sheathing.

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EIGHT LIGHT DYNAMO.

BY GEORGE M. HOPKINS.

(*Continued from page* 262.)

The making of a good commutator is not the smallest item in the construction of a dynamo. It is a very important part of the machine, requiring good workmanship and the best of materials.

The commutator cylinder in a machine of this class is formed of a series of bronze bars, separated a short distance from each other, and carefully insulated. On the eight light dynamo it is 1½ inches in diameter and 2 inches long. The bronze sleeve, A, which is fitted to the shaft and provided with a fixed flange and a set screw at one end, is screw-threaded at the opposite end to receive the screw-threaded bronze flange, B. On the sleeve, A, between the fixed flange and the removable flange, B, is placed a vulcanite sleeve, C, and to the ends of this sleeve are fitted two collars, D, of vulcanized fiber or analogous insulating material. These collars are beveled on their inner surfaces, and are thickest at their peripheries. To the vulcanite sleeve, C, is fitted a bronze cylinder, E, having conical ends, fitted to the beveled collars, D, as shown at 5 in Fig. 6. The bronze cylinder is slitted longitudinally in a gear cutter, or in any other convenient way, so as to divide it into 24 equal divisions, the slits extending nearly through the cylinder, as shown at 1. Before the bars are separated they are marked with figure punches, in regular order from 1 to 24, so that they may be rearranged after separation. Besides this, a sheet of mica is selected which can be crowded into the slits. Now, if the slits have been made deep enough, the bars may be broken off one after another, and the fin may be removed with a file; but if the bars cannot be broken off in this way, they may be removed by means of a hack saw, as shown at 2.

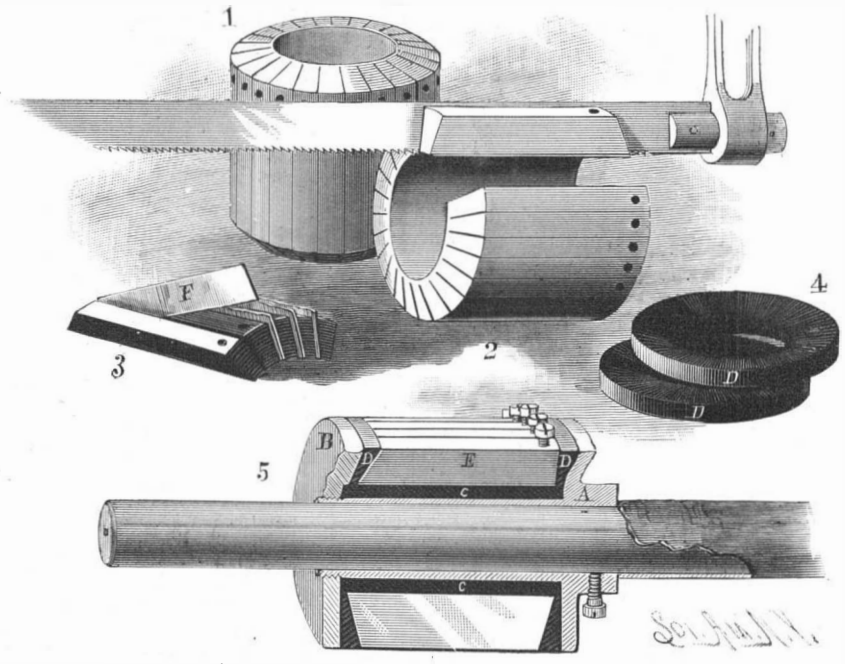

Fig. 6.—THE COMMUTATOR CYLINDER.

As many strips, F, of mica are cut from the sheet as there are bars in the cylinder, the mica strips being made a little wider than the bars and of exactly the same length, as shown at 3.

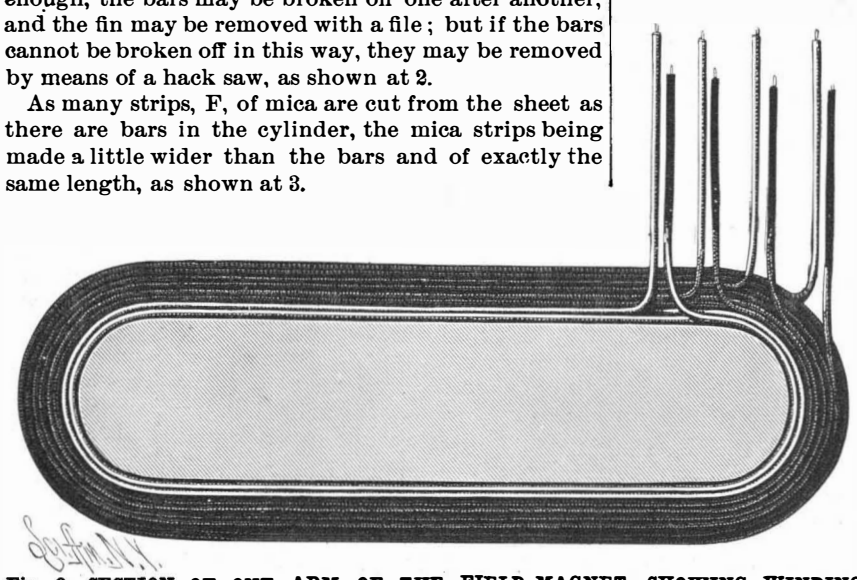

Fig. 9.—SECTION OF ONE ARM OF THE FIELD MAGNET, SHOWING WINDING.

The commutator bars thus formed are placed between the collars, D D, in alternation with the mica strips, with the bars arranged according to their numbers. The flange, B, is then screwed up tightly, clamping all the bars and the mica strips firmly in their places, each bar being thoroughly insulated. The cylinder thus made is placed upon an arbor and carefully turned off to bring it to a true cylindrical form. After turning, each bar is drilled near one end to receive the brass screw by which the armature wire is connected with the commutator bar.

The commutator cylinder, now finished, is secured in its place on the armature shaft, with the screws adjoining the body of the armature.

Now, for convenience in handling, the armature shaft is placed in the lathe, and the inside and outside terminals of one coil are carefully straightened out, parallel with the sides of the armature, and their ends are stripped of the insulating covering for a short distance and thoroughly scraped. The screws in two of the commutator bars, say 1 and 2, are loosened so as to permit of placing the looped ends of two wires under them. The outer terminal of the coil is connected with one of the screws, and the inner terminal of the same coil is connected with the screw in the next bar in order in the commutator cylinder. The outer terminal of the second coil is connected with the screw last referred to, and the inner end is connected with the screw of the next bar in advance, and so on around the entire commutator cylinder, the outer end of each coil being connected with inner end of the adjacent coil and with a bar of the commutator cylinder by one of the screws, as shown in Fig. 7.

The brushes which bear upon opposite sides of the commutator cylinder are each made of six thin strips of hard rolled copper, thirteen-sixteenths inch wide and three inches long, split from their free ends toward their clamped ends, to render them more elastic. The brushes are clamped in mortised studs passing through holes in the ends of a bar fitted to and adjustable on a boss formed on the inner side of the bronze yoke around the shaft. By this arrangement the brushes may be adjusted for taking off the current to the best advantage. The mortised studs which hold the brushes are separated electrically from the bar by insulating thimbles and washers, and upon the outer ends of the studs are screwed binding posts, in which are inserted conductors, bent into spirals to permit of the adjustment of the brushes. One of these conductors communicates with one of the binding posts on the machine base, while the other communicates with one of the rods extending to the top of the field magnet. The remaining binding post on the base is connected with the other vertical rod, extending to the top of the magnet. These vertical rods are connected with the terminals of the winding of the field magnet, as shown in Fig. 1.

The circuit of the machine is clearly shown in Fig. 8,

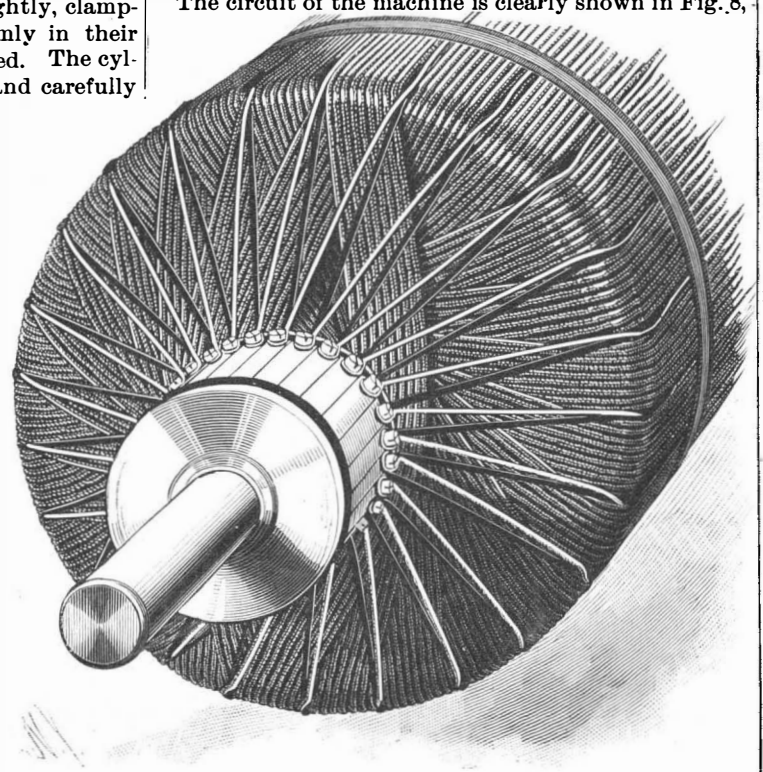

Fig. 7.—CONNECTIONS OF THE ARMATURE COILS AND COMMUTATOR CYLINDER.

the current passing from the armature, C, through the upper brush, thence to the top of arm, A, of the magnet, down that arm, then up to the top, then down the arm, B, and up, then downward to the base of the machine, terminating at *a*. The lower or remaining brush is connected with conductor, *b*. From the terminals, *a b*, the current is taken off for use.

In Fig. 8, for the sake of clearness, only a single conductor is shown on the field magnet, but in practice there are four, each conductor passing down and up once on each arm of the magnet; that is to say, there are eight layers of wire on each arm of the magnet, formed of four wires, each wire being laid on by beginning at the yoke, winding down to the shoulder of the polar extremity, then up again to the top, leaving the inside and outside ends projecting, as shown in Fig. 9. The winding is best done in a lathe.

In the present case all of the inner ends of the wires of the arms of the magnet are connected together, and all of the outer ends of one arm of the magnet are connected with one of the vertical rods, while the outer ends of the wires of the other arm are connected with the other vertical rod, as shown in Fig. 1.

By winding the field magnet with No. 18 wire in the manner described, several advantages are secured, one of which is the facility with which the work of winding may be done; another is the possibility of connecting the wires in different ways, so as to secure more or less resistance in the magnet. Another is that the wires may be conveniently connected up according to the various methods of winding, compound, shunt, series, etc.

As shown in the engravings, all of the wires of the field magnet are in parallel circuit, practically forming a large conductor of small resistance, and the conductor thus arranged is connected in series with the armature, that is, the current from the armature passes directly through the field magnet and external circuit.

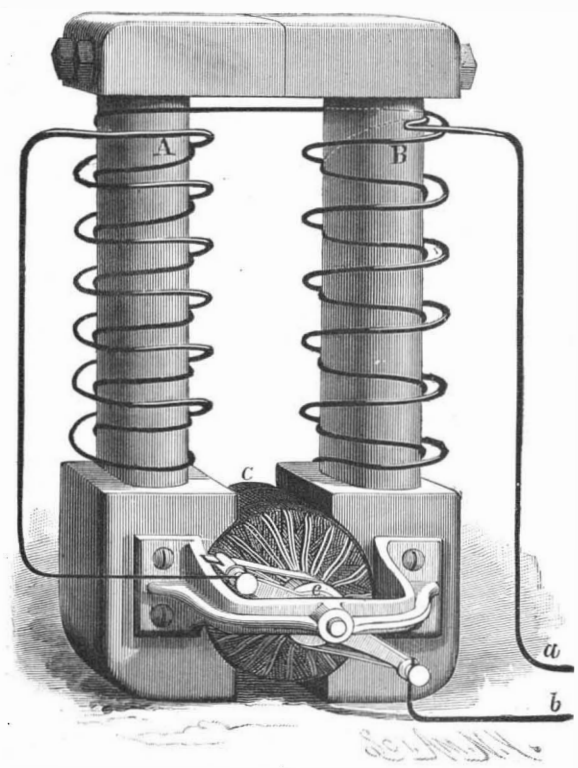

Fig. 8.—THE CIRCUIT OF THE DYNAMO.

Having made the dynamo and connected it up in the manner described, the brushes are to be brought into contact with the commutator cylinder at points diametrically opposite each other, and at points about opposite the center of the space between the polar extremities of the field magnet. The armature is revolved in the direction of the free ends of the brushes, and in the binding posts on the base are inserted short wires, which may be brought into contact with each other momentarily as the armature revolves.

If a spark is seen on the separation of the wires, it shows that the magnetism inherent in the iron of the field magnet is sufficient for the starting of the machine, and no further manipulation other than the adjustment of the brushes is necessary. The brushes should be adjusted to a point where the least sparking is produced. This will not vary much from the original position. The machine from which the engravings were made produces no noticeable sparks at the commutator.

If the machine fails to start, when tried in the manner above indicated, a battery of four or five Bunsen cells must be connected with the binding posts, or a dynamo may be used instead of the battery. It sometimes requires a few minutes to start the current, but as soon as it begins, the battery should be removed.

Some care is necessary in handling the conductors,

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as it is quite possible to receive a severe shock from this machine. The description of this dynamo, in connection with scale drawings, will be presented at an early date in the SCIENTIFIC AMERICAN SUPPLEMENT, together with the various methods of connecting the wires of the field magnet, and points in regard to external circuits. The results of dynamometric and electrical tests will also be given.

EXERCISES IN PRESTIDIGITATION.

I recently had an opportunity of being present at some amusing experiments of a prestidigitator, who was good enough to let me into the secret of his most curious tricks for the benefit of the readers of *La Nature*. Although it merely concerns the question of a deception of the eye, I shall make known the means employed for changing ink into water, or, rather, for really making credulous spectators believe that ink can be so changed.

The prestidigitator places upon a table a glass half full of a black liquid that has every appearance of being ink. He shows the spectators a white card, dips it into the glass, and takes it out stained with black (Fig. 1, to the left). This done, he conceals the glass under a napkin or handkerchief; then he suddenly removes the latter, and the glass is seen to contain a clear liquid, which is water (Fig. 1, to the right). This trick excites very great astonishment when it is well performed; but nothing is easier than to repeat it.

Pure water is poured into a tumbler, and the lower part of the latter is lined with a strip of black cloth, flannel or cashmere, up to the level of the liquid. At a certain distance off this gives the water every appearance of being ink. Previous to this a card has been prepared by coloring a third of one of its sides with black ink. When this card is shown to the spectators, it is presented to them white side foremost. After it has been dipped into the alleged ink, it is turned around so as to show the inked surface, and it then appears as if it had really been immersed in ink.

Then the glass is covered with the fabric, and the latter is inserted into it far enough to allow the fingers to grasp the black lining and quickly remove it, and thus make the black liquid appear as water.

This experiment shows with what facility certain mystificators can practice deceit when they present their experiments as being under the influence of supernatural agents.

Experiments of the same nature may be more scientifically performed by means of chemical precipitates. Add tincture of iodine to crystallized acetic acid, and you will obtain a red liquid having the appearance of wine. Pour into the mixture a solution of hyposulphite of soda, and you will obtain a milk-white liquid, and the wine will seem to have been converted into milk. Put some iodide of potassium into an aqueous solution of a salt of mercury (the bichloride, for example), and you will have a red precipitate of iodide of mercury. An excess of the reagent dissolves the precipitate, and the color disappears. This latter experiment is very curious, since the two liquids have the appearance of water. While we are on this subject, we may mention, in conclusion, the curious tri-colored artificial flower that a toy manufacturer annually brings out (Fig. 2).

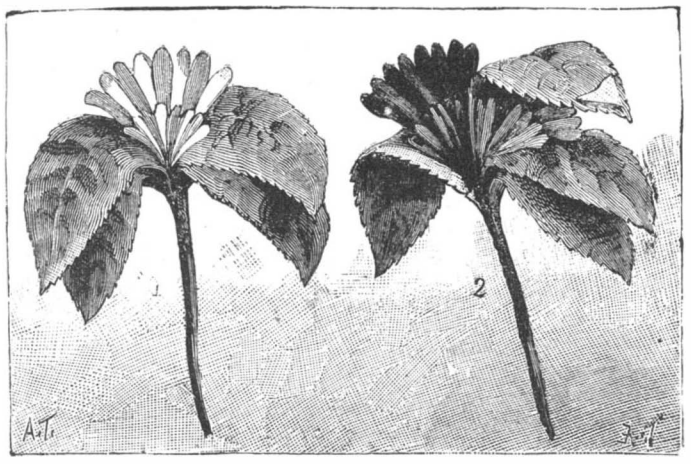


Fig. 2.—THE MAGIC FLOWER.

To the left of this figure (No. 1) we see a white flower. This, by an abrupt movement of the arm, is rendered red, and then by another movement blue. The white flower, which is of thin paper, is folded like a fan, and is placed between two flexible leaves, that are provided at their upper extremities with a small piece of lead. By a dexterous movement the green leaf is raised and the white flower is folded under its weight, and a red flower makes its appearance on one side and a blue one on the other. If the motion be quick, the eye cannot discern the means that are employed to effect the transformation, which may be regarded as an amusing optical experiment. —*La Nature.*

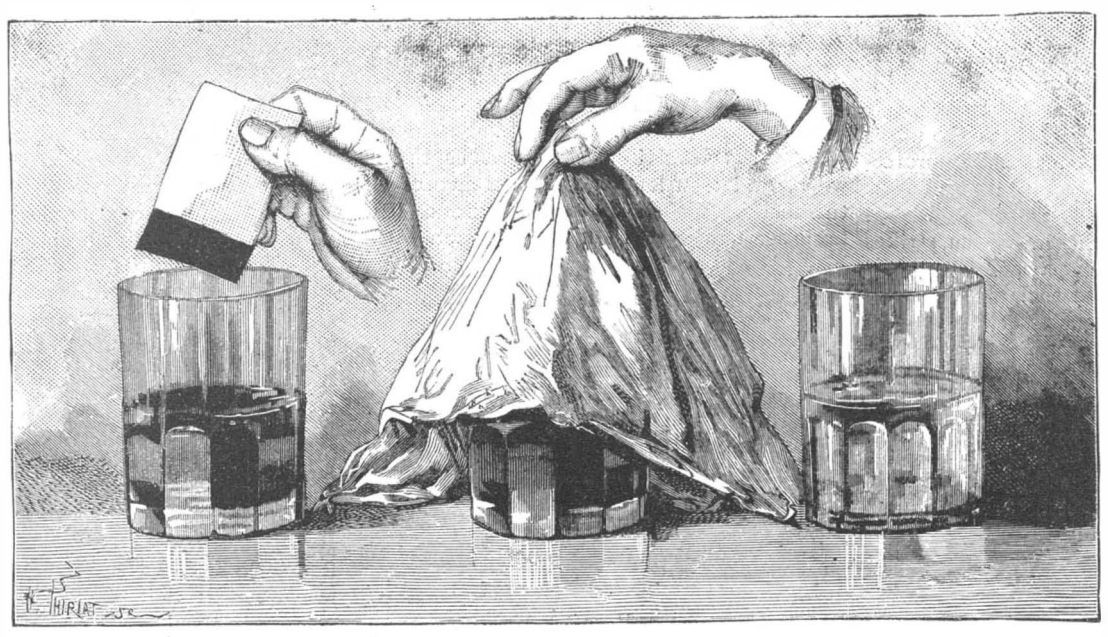
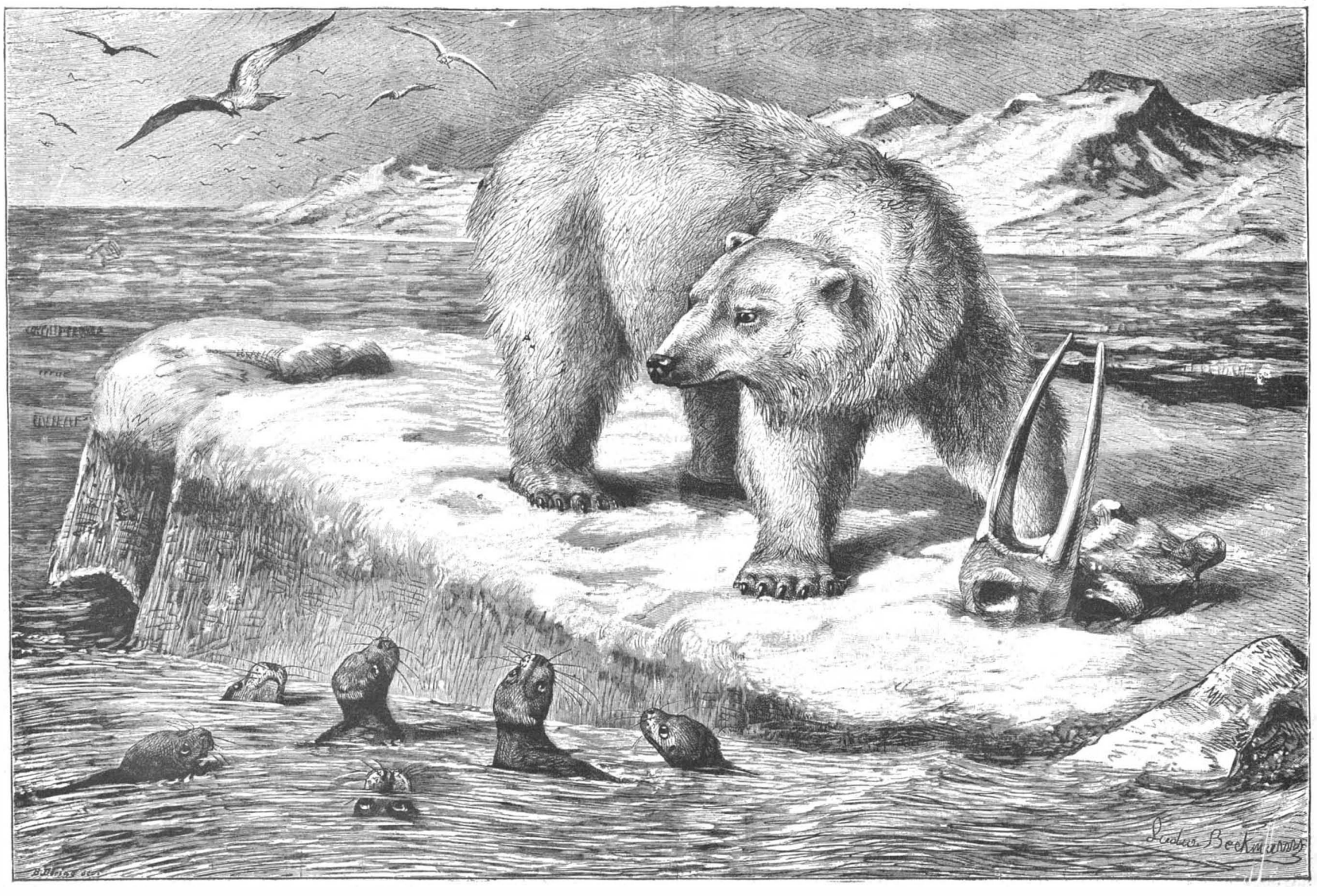


Fig. 1.—INK CHANGED TO WATER.

THE POLAR BEAR AND SEALS.

On the long stretches of ice-covered coast in the polar regions, the largest beast of prey of the North—the white or polar bear—lives undisturbed by all other animals, seldom meeting even the walrus or seal hunters in this vast desert. If a bear is discovered on floating ice, it will usually jump into the water on the approach of the boat, in order to reach the shore or a larger field of ice, and this is the time when he can be most easily killed. Rowed by strong arms, the boat will soon overtake the fugitive; but it should be kept at a proper distance from him, so that he can be shot by one of the occupants of the boat. The capture is not always an easy matter, however. The Scotchman



THE POLAR BEAR AND SEALS.

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Lamont, who hunted walruses for many years, tells of one such chase in which, when the boat had approached within fifty feet of the bear, he turned suddenly and swam toward his pursuers. The original intention of harpooning him was abandoned, and a well aimed shot killed him when he was very near the boat. Scoresby relates an amusing incident which occurred during a "water hunt" of this kind, which came very near having a tragic ending. On this occasion the bear swam to the boat, climbed in, and remained there quietly, while the terrified men sprang overboard, and clung to the boat until the men in a second boat, which came to their assistance, shot the intruder.

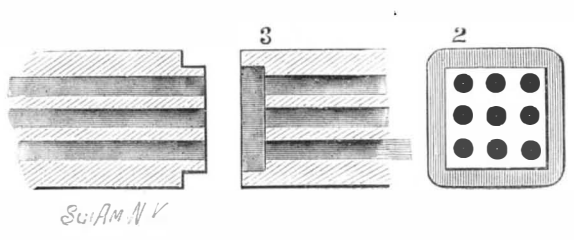
The food of polar bears consists principally of the refuse of the sea, that is, the bodies of the larger animals which are washed up by the sea; but they also attack living seals and walruses, and the deep scars on the bodies of the latter which are taken by the seal hunters prove that the bears are not afraid to attack these immense creatures. They prefer to surprise the walrus in his sleep, and at such a time a bear will fix his teeth in the walrus' neck and hold him while he strikes him with his paw, first stunning and then killing him. If, by scent or sight, a bear discovers seals sleeping on the ice, he slips noiselessly into the water and swims to the desired place, rises, under the protection of a ledge if possible, so as to obtain a good view of his prey, and selects a seal which is sleeping near the edge of the ice. Then he approaches his victim, strikes him a sudden, heavy blow with his paw, breaking his back, and throws the unfortunate seal about on the ice, while his companions hasten back to the water.

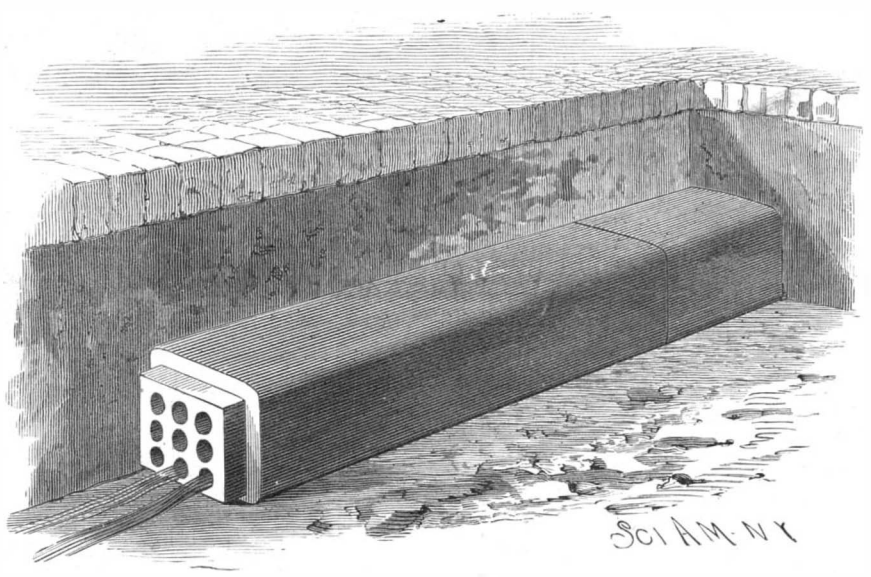
The order of things is reversed if seals meet their foe in the water. Sure of their greater facility in swimming and diving, the seals have no fear of the bear, and they know how to tease him, swarming about him, then suddenly diving out of sight, and then reappearing. Lamont, who has often witnessed such scenes, compares the conduct of the seals on occasions of this kind to the hectoring of large birds of prey by small birds.

Our cut shows a polar bear on floating ice trying to satisfy his hunger on remnants of a walrus' skeleton, but he is disturbed in his occupation by some merry seals swimming near the ice. The bear looks covetously at the sleek, fat seals, and then returns ill-naturedly to the dry walrus bones.—*Illustrirte Zeitung.*

CONDUIT FOR UNDERGROUND CONDUCTORS.

It is a well known fact that the electrical wires that now cover the roofs of almost every building in the large cities and cumber the streets have been the indirect cause of the destruction of much property, and perhaps of the loss of life, by most seriously delaying and interfering with the firemen. The necessity for getting rid of this nuisance has caused inventive genius to devise means for accomplishing this object. The illustrations herewith presented represent a conduit for electrical wires of all descriptions. It consists of rectangular tubular blocks, about four feet in length and a foot square. Each block is provided with a male and female joint, as shown in the sectional view, Fig. 3. The conduit is formed with nine ducts, each of which will hold one hundred and fifty telegraph wires, or two hundred telephone wires, or seventy-five electric light wires. The material of which the conduit is constructed is of the nature of a cement, which quickly hardens when exposed to a chemical process in an air tight inclosure. The material is then unaffected by heat or cold, is impervious to moisture, is capable of standing a pressure of 3,441 pounds to the square inch, is hard as the hardest cement, and is, it is claimed, as good a non-conductor as glass. The process of manufacturing these conduits can be carried on rapidly, and they can therefore be made at a reasonable cost. Fig. 1 is a perspective view, showing the conduit as it is laid for the reception of wires. Suitable branches are provided, whereby wires can be carried into each house along the line.





CONDUIT FOR UNDERGROUND CONDUCTORS.

This conduit is manufactured by the American Conduit and Conducting Company, of 7 Charlestown St., Boston, Mass. Applications have been made for patents on improved machinery, by means of which this conduit can be cheaply made. The capacity of four of these machines is one mile in seven days.

An Interesting Family.

"Spiders! What can any one find interesting in those ugly little creatures?" is a question I often asked before I made the acquaintance of "my family." The interest which I felt in its members led me to examine more closely the life and habits of spiders, and I find that observation not only deepens my interest, but also increases my admiration for this wonderful animal, which was first awakened by the mother of "my family." I first saw her moving slowly over a stone. Something, I knew not what, gave her such a peculiar appearance that, overcoming my natural aversion to spiders, I secured her in a box in order that I might examine her to better advantage.

The back of her abdomen was very rough, and its surface seemed to be in constant motion. The microscope showed that the abdomen was covered with young spiders. At first they were not very active, and seldom left their mother; but after a couple of hours they endeavored to escape whenever the cover was removed from the box in which they were confined. On attempting to pick up one of them, I found it had attached itself, by a minute thread, to its parent. Different trials showed that each little spider took the same precaution against any possible accident.

Although the family was well supplied with flies and other insects, they seemed to prefer each other, and their number rapidly diminished, until one day the whole family met with a fatal accident. This I have always regretted, as it prevented my learning the name of this strange family, but from what I know of the tarantula, I think it may have been a relative.—*The Owl.*

Modern Uses of Tin.

The uses of tin have greatly increased during the last few centuries of our era. Salmon, in his splendid work on casting tin (1788), describes the methods of work, and mentions the objects manufactured from this metal. We see from the plates of his atlas that table services (spoons and forks), pitchers, jugs, candelabra, lamps, surgical instruments, chemical apparatus, boilers for dyeing in scarlet, etc., were being put upon the market in the most varied forms at that epoch.

Griffith, between 1840 and 1850, perfected the manufacture of tin utensils in a single piece. This industry became especially developed in France from 1850 to 1860.

In 1876 America began manufacturing impermeable boxes, without soldering, from single pieces of this metal.

To-day, tin is being used in the manufacture of bronzes for guns, money and medals, and in the alloys used for making measures of capacity for liquids. Its unalterability in the air, and the harmlessness of its salts when they exist in small quantity, cause it to be employed in our day in the manufacture of culinary vessels and utensils. Advantage is taken of its malleability to form from it those thin sheets that are used as wrappers for chocolate, tea, etc.

In the various bronzes that it forms with copper, we have evidence of the influence that the relative proportions of the two metals has upon the properties of the alloy. Thus, gun bronze, which contains 10 parts of tin to 90 of copper, is remarkable for its tenacity. The bronze of tom-toms and bells, which differs from the last named only in its larger proportion of tin (20 to 80 of copper), is, on the contrary, very brittle, although it fortunately possesses greater sonorousness than gun metal does. On still further increasing the proportion of tin to 33 parts per 67 of copper, we obtain a white alloy, capable of taking a polish that causes it to be used for the manufacture of telescope mirrors. Upon uniting with tin, copper loses its ductility. The alloys of these two metals increase in density through being hardened, as they do also by being hammered.

A mixture of 20 parts of tin with 80 of copper gives an alloy which is brittle at a bright red heat and when cold, but which is malleable at a dark red heat.

When alloyed with lead, tin forms plumbers' solder. Associated with mercury, it gives the silvering of looking-glasses. Besides this, it enters into a host of fusible alloys or compositions, known under the general name of white metal. One of these alloys, composed of tin, antimony, and copper, is very much used as a bushing for engine bearings. For this purpose, the following are very good proportions: Tin, 100; antimony, 10; copper, 10. It is also alloyed with antimony alone, or with bismuth. It serves for tinning copper and iron kitchen utensils. To this effect, the wrought iron utensils are first cleaned with sand and then wiped, and afterward immersed in a bath of molten tin, and finally rubbed with tow saturated with sal ammoniac. Food cooked in tinned vessels has a slight fishy taste, because it dissolves a little of the tin, just as food prepared in iron contracts a slight taste of ink.

Tin is used in enormous quantities also in the manufacture of tin plate. In order to prepare this, the sheet iron designed for the manufacture of it is cleansed by plunging it into dilute sulphuric acid, which dissolves the pellicles of oxide. Then it is rubbed with sand and immersed in melted tallow, and afterward in a bath of tin covered with tallow. When it is taken out it is tinned, there having formed upon the surface of the sheet iron a true alloy of iron and tin covered with pure tin. Tin plate is as unalterable as tin itself, because the iron does not come into contact with the air at any point; but if, upon cutting it, we expose the iron, oxidation proceeds more rapidly that it would if the iron had not been tinned.

Crystallized Tin Plate.—Upon washing the surface of tin plate with a mixture of hydrochloric and nitric acids, we remove the superficial layer and render visible the crystallized surface of the tin and iron alloy. We thus obtain what is called moire metallic or crystallized tin plate.

Phosphor Bronze.—It now remains for us to say a few words about the new and important use of tin for the preparation of phosphor bronze.

In the melting of bronze, the absorption of oxygen is very detrimental, the formation of an oxide of tin rendering the metal brittle. In former times an endeavor was made to prevent this oxidation by stirring the mass with wood, or by adding a little zinc to it; but for the last fifteen years greater success has been obtained by the addition of a little phosphorus. This substance extraordinarily increases the compactness, toughness, and elasticity of the product, and gives it, in addition, a beautiful golden color.

Guns, statues, ornaments, and bearings are now cast in phospho bronze with the greatest success.

Kunzel, of Dresden, has taken out a patent for an alloy composed of from one-half to 3 parts, by weight, of phosphorus, from 4 to 15 of lead, from 4 to 15 of tin, and, for the rest, copper up to 100.

Schiller & Sewald, of Graupen, prepare two kinds of phosphor bronze; one with 2½ and the other with 5 per cent of phosphorus. The demand for this article is daily becoming more extensive.

The most important uses of tin are, in Asia, for tinning copper, and, in Europe and America, for the manufacture of objects from tin plate. The manufacture of bronze and white metal likewise consumes a large quantity.—*Bull. de la Societe de l'Indust. Minerale.*

Heating Cars by Steam.

The superintendent of motive power of the New York, New Haven, and Hartford Railroad, Mr. John B. Henney, Jr., has devised a system of car heating which, it is said, has given satisfactory results. The exhaust from the Westinghouse air pump is delivered into the ordinary radiating pipes of the Baker system. A recent trial of the system is thus described:

"In order to ascertain how quickly four cars can be heated by the steam from a locomotive, orders had been given during the forenoon to extinguish whatever fire there might be in the stoves. Then the windows of the cars were raised, and the raw March wind had an unobstructed passage through the cars. When the locomotive was coupled to the train, connection was established between the exhaust steam pipe on the side of the locomotive and the steam pipes that extended through the several cars, the old pipes in the cars being used for the experiment. Despite the frigid atmosphere in the cars at the commencement of the experiment, caused by these open doors and windows, in thirty minutes from the time the windows were closed and steam let on, the cars were as warm as stoves could possibly have made them. The train made the run to New Haven in fifty-five minutes, and the last car was kept as warm as the first. It required no more steam, and, consequently, no more fuel, than was needed to run the engine, the steam used for heating having before been wasted. The pipes are so arranged that, in case of accident, the steam can be let out instantaneously from the outside of the car, thereby preventing any injury from scalding by steam."

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APPARATUS FOR DETERMINING THE SPECIFIC GRAVITY OF LIQUIDS.

BY T. O'CONOR SLOANE, PH.D.

The determination of the specific gravity of solids and liquids is one involving many precautions, if accurate results are to be attained. Water is the basis, its temperature being placed at 4° C. In practice it is the actual standard, the substance being generally compared in weight with an equal volume of real water. The water used should be distilled, and if not recently prepared, should be boiled and allowed to cool. This is necessary in order to be certain that it contains no dissolved gases. It may be said that reliable determinations of specific gravity have, as a rule, involved the use of a delicate balance. This condition has prevented accuracy in cases where no balance was obtainable, or where its use was inadmissible. The great family of hydrometers of Baume, Twaddell, Nicholson, and others, are far from exact, but have been devised to meet this want—an accurate method not requiring a balance.

The hydrometer is, for several reasons, an unsatisfactory instrument. Its accuracy depends on the invariable volume of a solid. If made of metal, it may become indented, and so destroyed. If made of glass, unless allowed to stand for a long time before graduation, its volume may slowly change. Such alteration of cubic contents is often observed in thermometers. From this cause one radical defect attaches to the system. To make them sensitive, the stem on which the graduations are marked has to be of small diameter, and, consequently, of great length in proportion to the range of its scale. Accordingly, to cover the cases of liquids of varying specific gravity, to which branch of the subject these notes are especially directed, several hydrometers are found necessary. Capillarity introduces another source of error. In the same liquid the same hydrometer will give different readings, according to the way it is manipulated. The liquid adhering to its stem, where it emerges from the surface, pulls it down to a greater or less extent. If the hydrometer is pressed down and allowed to rise slowly, it will give a lower reading than if just allowed to settle to a position of rest. In different liquids the error of capillarity is still more serious, and cannot be avoided or allowed for. Finally, as a mere matter of practice, it is impossible to read the instrument with any accuracy, the intersection of the liquid surface with the hydrometer stem not defining a sharp line.

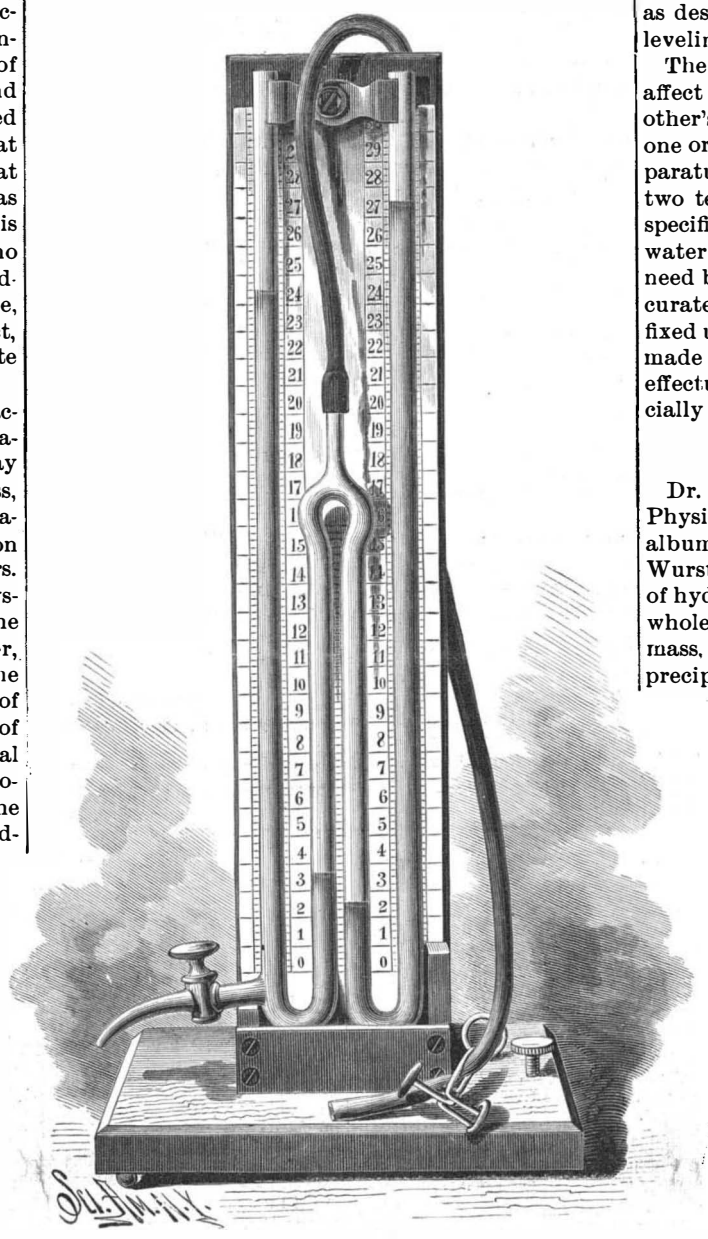
The apparatus here illustrated obviates these objections. It gives a definite reading. One apparatus can be used for liquids of all specific gravities, and errors due to capillarity are completely avoided. It is based on the law of the pressure of liquids, which states that the height of two columns of fluid that are in equilibrium is inversely proportioned to their specific gravity. This principle was the basis of Dulong and Petit's method for determining the coefficient of the absolute expansion of mercury.

A glass tube is bent into the shape indicated, and provided with a nozzle at the central bend for the attachment of an India rubber tube. A pinch cock is used to close the latter. As shown in the cut, one of the lower bends is provided with an outlet cock, also of glass. This may be omitted, as it is only a matter of convenience and neatness, enabling the manipulator to more easily change the fluid where several determinations are to be made in succession. The tube should be about 12 millimeters (½ inch) internal diameter. In height it need not exceed 400 millimeters (16 inches), though for accurate work it should be two or three times as high. This applies to the long members. The central portion should be a little more than half as high.

The tube is mounted on a stand provided with a leveling screw. Back of it is a mirror, which should be of good quality, free from striæ or bubbles. The tube lies snugly against this. On the mirror a scale is marked for all four members of the tubing. The graduation must be executed with the greatest accuracy. The lines must lie all in one direction, parallel to each other, and those on one side should be continuations of those on the others. If this condition is departed from, at the very least the scales for the short and long tube on either side must be identical in level as far as the short one extends. The scale need not be etched or engraved on the mirror. It may be marked upon the front of the tube.

To determine the specific gravity of a liquid, water is first poured into the right hand tube, until the short tube is filled nearly to the bend. The apparatus is now leveled with the leveling screw seen passing through the base, the water being used as the gauge.

In reading the height of the columns, the eye is so placed that the division of the scale nearest to the water level bisects the reflection of the retina in the mirror. The level of the water can then be read off within a small fraction of a millimeter. The fluid to be tested is poured into the left hand tube,



APPARATUS FOR DETERMINING THE SPECIFIC GRAVITY OF LIQUIDS.

in about equal quantity. By blowing into the rubber tube, the water and other fluid are forced down the center tubes and up in the outer. When the inner columns have sunk nearly to the bottom of the tube, the rubber tube is closed by a pinch cock. The pinch cock is best applied close to the glass nozzle. Upper and lower readings for both liquids are taken, just as in a siphon barometer. The lower readings are subtracted from the upper ones, giving the true and relative heights of the supporting columns. The height of the water column is divided by that of the other column, and the quotient is the specific gravity.

The best method of leveling the apparatus is to first pour water into both sides, to force it upward as described, and take regular readings and adjust the leveling screw by these observations.

The different capillarity of various liquids does not affect the observations, as the surfaces counteract each other's effects. There is no trouble in reading within one or two tenths of a millimeter, so that in an apparatus a meter high the readings would be within two ten-thousandths, and the quotient expressive of specific gravity of course much closer. As the same water will answer for a series of observations, no cock need be supplied for drawing it off. For extremely accurate work, a rather large diameter of tube should be fixed upon (20 mm. or ¾ inch), and the tubes should be made long. As above suggested, a meter (39·37 inches) effectual height would be sufficient for any work, especially if the readings were taken with a cathetometer.

New Albumen Precipitate.

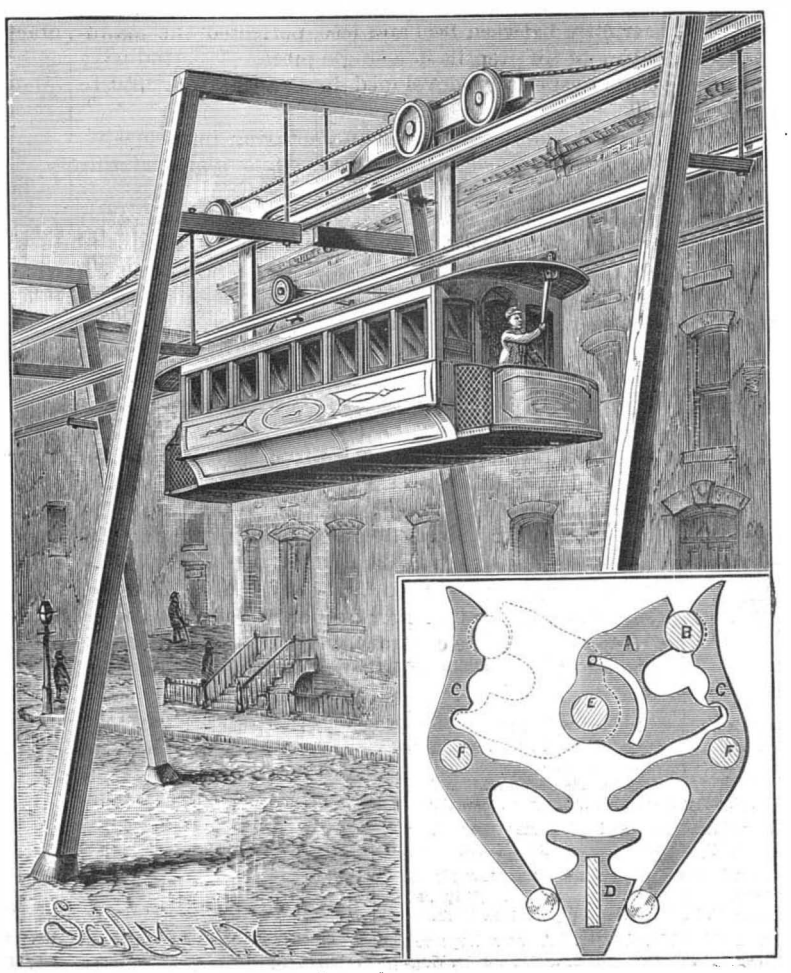
Dr. Gad has made a communication to the Berlin Physiological Society respecting the peculiar, strange albumen precipitate with salt recently described by Dr. Wurster. If to the white of eggs lactic acid, peroxide of hydrogen, and common salt were added, almost the whole of the albumen was precipitated as a white flaky mass, perfectly similar in appearance and taste to newly precipitated caseine (curd), but distinguished from caseine by its chemical reactions. The easy digestibility of this form of albumen, which had hitherto been precipitated by no other reagent, was especially remarkable. It was interesting that, in accordance with the reactions shown by Dr. Wurster's test paper for active oxygen, hydrochloric acid was formed on the mixture of lactic acid, peroxide of hydrogen, and common salt, and this acid *in statu nascendi* might be the specific precipitate for this new form of albumen, which could be obtained just as well from blood serum as from white of eggs.

ELEVATED CABLE ROAD WITH SUSPENDED CAR.

The road herewith illustrated has many novel features in the construction of the car and method of suspending the same, and in the device for gripping the cable. The car is hung upon two rods suspended from a narrow truck having four wheels at one end and two at the other; these wheels run upon rails suitably supported at the top of the structure. The truck carries the gripping device and small sheaves over which the cable runs. Extending across the roof of the car is an axle provided at each end with a wheel adapted to run upon side rails, as shown in the engraving; these wheels prevent the swaying of the car, and serve to keep it in proper position. The car may be hung at any desirable distance from the ground, to leave sufficient head room in the street.

The small engraving represents the grip, which is so constructed that the cable moves from one side to the other when passing a curve. The cable, B, is held between one of the jaws, C, and the revolving jaw, A, which is pivoted upon the pin, E. When rounding a curve, the cable slips to the opposite side of the grip and takes with it the revolving jaw around to the other catch, and engages that plate, C. This insures the cable being always in a straight line. The wedge, D, is drawn downward to separate the lower arms of the jaws, D, pivoted on the pins, F, and cause their upper arms to grip the cable, and is raised when it is desired to release the cable. This wedge is operated through suitable connections from the platform of the car.

This invention has been patented by Mr. N. Kirchner, Davis Hotel, Market Street and Delaware Ave., Philadelphia, Pa., who may be addressed for additional information.



KIRCHNER'S ELEVATED CABLE ROAD WITH SUSPENDED CAR.

Washing out the Stomach.

This operation, such a novelty a few years ago, is coming quite in vogue. A Maryland doctor employs the method very extensively in some cases of dyspepsia. The following is the *modus operandi:* A soft red rubber tube is passed gently down into the stomach, quite to the pylorus; with this is connected about a yard of common flexible tubing and a glass funnel, which is held on a level with the patient's breast, and tepid water is poured slowly into the funnel until a sensation of fulness is experienced. The funnel is then depressed to the level of the waist, and the fluid allowed to siphon out. The process is repeated until the water returns quite clear.

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ENGINEERING INVENTIONS.

An apparatus for cooling car axle boxes has been patented by Mr. Jerome Eugene Tourne, of New Orleans, La. It consists of pipe connections whereby the exhaust steam is made to flow to the several car axle boxes, and through which also a powerful current of live steam may be directed if desired.

A railway switch has been patented by Messrs. Hugh C. Cannon and Joseph P. Canty, of McArthur, Ohio. It has a radially swinging section, spring tongues, lever, bell cranks and pull rods, making a novel construction of frogless switch, designed to be more effective and reliable than similar devices have heretofore been.

MISCELLANEOUS INVENTIONS.

A holder for collars or cuffs has been patented by Mr. Theodore Gentzsch, of Brooklyn, N. Y. It is a simple holder, quickly and easily applied, and will securely attach either a collar or cuff to the proper band of a shirt.

A peach stoner has been patented by Mr. James H. Smith, of Little Rock, Ark. It is strong and simple in construction, and designed to work with great rapidity and certainty, being calculated to stone from three and a half to four bushels of clingstone peaches per hour.

A combined mitten and sleeve for garments has been patented by Mr. George M. Wright, of Shelbyville, Ind. It is made of rubber or similar material, and consists of a sort of glove, so formed and attached to a sleeve that it may be folded back upon the sleeve to constitute a cuff.

An adjustable chair back has been patented by Mr. George J. Shults, of Avoca, N. Y. Its construction is such that by loosening certain nuts the side bars may be elevated or depressed, and the adjustable section may be conveniently clamped in any position to which it has been moved.

A scroll saw has been patented by Mr. William M. Moore, of Empire City, Col. It is cylindrical, being a round bar with cone shaped and spirally arranged teeth, and spiral grooves impressed into the bar, so that it may be made to follow a great variety of curves running in different directions.

A straw board lining machine has been patented by Mr. Ebenezer Spooner, of New York City. It is for pasting thin paper on sheets of straw board, and is so made that the paste is automatically applied to the web of the paper, and the board and lining material carried forward so that excessive moisture is extracted, and the boards cooled before delivery.

A broom holder has been patented by Mr. Alberto Finks, of New Berlin, N. Y. It is formed of a metal plate, that may be quickly struck or stamped out at one operation, and then bent to proper shape, so that it will rest close against the wall, making a device into which the broom handle can be easily forced, and thus be held out of the way.

A cigar perforator has been patented by Mr. Leman C. Miner, Jr., of Brooklyn, N. Y. Combined with a slotted and apertured casing is a needle working in guides therein, and a spring-actuated lever, having one of its arms projecting through the casing and the other connected to the needle, with other novel features, to facilitate giving cigars a free draught.

A medicated calcimine has been patented by Mr. Thomas E. Costello, of Brooklyn, N. Y. It consists of whiting or Paris white, corrosive sublimate, salicylic acid, and solution of Irish moss, to be applied with a brush in the usual manner, when it dries rapidly without showing laps or seams, and makes a good disinfectant and insect destroyer.

A horse detacher has been patented by Messrs. Walter L. and Philip M. Mitzel, of Felton, Pa. Combined with a singletree having spring-seated bolts at its ends is a retracting cord and a metal bar carrying pulleys for the cord and connected to the singletree and its ferrules, whereby the driver can readily disconnect the traces of a fractious horse from the singletree of the carriage.

A grain scourer has been patented by Mr. David Etnier, Jr., of Mount Union, Pa. Combined with a conveyer and cylinder, and fixed and rotating rubbers, is an annular hood or case surrounding the rubbers, and a brush fastened on the movable rubber, with other novel features, whereby the kernels of the grain will be freed from fuzzy or light particles and scoured properly for grinding.

A tool for making spiral springs has been patented by Mr. Johan T. B. Siden, of Nybo, Waldo, Sweden. It consists of a pair of tongs with its legs united at one end and having threaded jaws, in combination with a holder adjustable in a keeper having a sliding connection with one of the legs, to facilitate the winding or coiling of hardened steel wire into cylindrical or conical springs.

A photographic print washer has been patented by Mr. John T. Long, of Menomonee, Wis. It is a rocking tray, pivotally supported in the lower part of the frame, with forked arms for engaging studs projecting from the side of the print-washing tray for communicating an oscillating motion from the rocking tray to the swinging tray, with automatically operated valves, etc.

A safety mechanism for torpedo tubes has been patented by Mr. Emil Kaselowsky, of Berlin, Germany. This invention provides a mechanism designed to obviate the dangers of admitting compressed air to the tube to discharge the projectile before the cover has been removed, furnishing also the means for releasing or withdrawing the brake blocks or retaining studs.

A wheel and axle has been patented by Mr. John Pettinger, of Santa Barbara, Cal. In combination with a fixed axle are sleeves turning loosely therein and carrying hubs, with a continuous tubular spindle passed through the sleeves and turning freely therein, with other novel features, making a construction that is very cheap, and in which extreme lightness is combined with the greatest strength.

A stove grate has been patented by Mr. Horace Hatchman, of St. Louis, Mo. It consists of an oblong frame in connection with a series of grate sections or fingers supported at their lower ends by hooks on a cross bar of the frame, and at their upper ends by arms projecting from the upper bar of the frame, being applicable to both heating and cooking stoves, and showing the fire all around if applied for such purpose.

A yard for ships has been patented by Mr. Duncan Campbell, of Fort Cauley, Auckland, New Zealand. It is a tubular yard formed of sheet metal, slotted in the upper and lower side, with a central connecting web or plate extending throughout the entire length of the yard, the ends having removable caps, and rods extending through the upper and lower part of the yard, opposite the slots, to receive double eyes attached to the sails.

A machine for making sheathing paper has been patented by Mr. William H. H. Childs, of Brooklyn, N. Y. It has two rollers, with one or more pieces closely fitting on their upper and inner surfaces, forming with such surfaces a trough or hopper arranged at intermediate portions between their ends, with other novel features, whereby the coating material may be applied more conveniently, as desired, to any part of the paper.

A cordage spinning machine has been patented by Mr. Elisha M. Fulton, of New York City. This invention covers a combination with a spinning or twisting and spinning mechanism of a series of chains, one in front of the other, instead of a single chain, as heretofore, for passing the sliver to the spinning mechanism or its flier, the chains being armed with pins to comb, draw, and take hold of the sliver, and made to travel at different velocities, in order to work a heavier sliver and give more perfect control of the draught. The invention also facilitates the running of the spinning mechanism at a high rate of speed, while producing a uniform cord.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The chief improvements in the 1885 "Trautwine" were those relating to railroad matters. "Rail Joints" and "Turnouts," "Locomotives," "Cars," and "Railroad Statistics" are new. "Trestles" and "Turn Tables" are greatly enlarged.

For Sale—Machine shop plant, in operation. Best tools. Address Chas. W. Griggs, 175 Dearborn, Chicago.

Wanted—One pair of power shears, capable of cutting 2 inch square iron. They must be in good condition. Address the James Cunningham, Son & Company, Rochester, N. Y.

Engines and boilers, 1 to 4 H. P. Washburn Engine Co., Medina, O.

Power users should read and builders of power app. should advertise in *Power*, 113 Liberty Street, N. Y.

The Australian-American Trading Co., 20 Collins St., West Melbourne. Sole agencies for American novelties desired. Correspondence solicited. Care of Henry W. Peabody & Co., Boston.

Wanted—A competent man to take entire charge of a factory where metal is cut, stamped, spun, and drawn into various forms. Only parties of practical experience and undoubted mechanical ability need apply. Answers must contain full details, with name and references, otherwise they will have no attention. Address L., P. O. box 2,304, N. Y. city.

We desire the services of a thoroughly competent man to take the place of our present secretary, who is obliged to retire on account of ill health, and to assist in general management. Experience and first-class business qualifications will be required, and to the right person excellent inducements will be offered. Great Western Mfg. Co., mill furnishers and manufacturers of general machinery, Leavenworth, Kans.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

For the latest improved diamond prospecting drills, address the M. C. Bullock Manfg. Co., 158 Lake St., Chicago, Ill.

Link Belting and Wheels. Link Belt M. Co., Chicago.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Protection for Watches.

Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any watch. Experimental exhibition and explanation at "Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F. S. Giles, Agt., or Giles Bro. & Co., Chicago, where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder*." A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Catalogue of books on civil and mechanical engineering, electricity, arts, trades, and manufactures, 116 pages, sent free. F. & F. N. Spon, 35 Murray St., New York.

For Sale—Patent No. 360,493. A new improved Dumping Wagon. For information address John Wagner, Olean, N. Y.

Timber Gaining Machine. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Curtis Pressure Regulator and Steam Trap. See p. 45.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 and 421 East 8th Street, New York.

Universal & Independent 2 Jaw Chucks for brass work, both box & round body. Cushman Chuck Co., Hartford, Ct

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

60,000 *Emerson's* 1886 ☞ Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Safety Elevators, steam and belt power; quick and smooth. D. Frisbie & Co., 112 Liberty St., New York.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Niagara Steam Pump. 20 years before the public. Always first premium. Adapted for all purposes. Norman Hubbard, Manufacturer, Brooklyn, N. Y.

Reliable reports and opinions as to infringement and validity of patents rendered by W. X. Stevens, 705 G St., N. W. Washington, D. C. For three years the government expert in patent causes, and twenty years an attorney before the Patent Office.

Machine drawing and designing. A. K. Mansfield, Chicago.

Rod, pin, and dowel machines. 1,000 to 3,000 lineal feet per hour. Rollstone Machine Co., Fitchburg, Mass.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

NEW BOOKS AND PUBLICATIONS.

DESIGNING WROUGHT AND CAST IRON STRUCTURES. Part III. Notes, calculations, tables, and working drawings for a rolled iron girder and flitched beam, with comparisons of strength by various rules. By Henry Adams, M. Inst. C. E., etc., Professor of Engineering at the City of London College. London, 1886. Demy 8vo. 30 pp., with one large plate. Published by the author.

Part III. consists of two subdivisions: The first treating of the method of designing girders to support masonry walls. Relation of depth of girder to its strength; the weight relative to area of section, strength of girders by various rules compared, and a masterly description of the method of arriving at correct results by the modulus of section determined by the moment of inertia. Second division treats of a special case of a flitched beam of Canada oak, and cost of painting. It is practically a series of studies upon wrought and cast iron construction, addressed to the architectural and engineering student, and particularly adapted to instruct the novice in the difficult art of constructional engineering. It is the best introduction to the study of the strength of materials we have seen, and the high character of its author will commend the book to the student's careful perusal. A typographical omission occurs on the formula given for the deflection of an I beam under a distributed load; it should read:

$$D=\frac{L^3Wc}{D^3B-d^3b}$$

the term d^3b having inadvertently been omitted.

* * Any of the above books may be purchased through this office. Address Munn & Co., 361 Broadway, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) C. W. T. asks (1) a cure for red hands, and also the manner in which it is to be used? A. Take 4 parts glycerine, 5 parts yolk of egg; mix thoroughly, and rub on after washing the hands. A little lemon juice will also assist to whiten the hands. 2. Does borax have an injurious effect if used in washing fabrics? A. It is much used for such purposes, and is not ordinarily injurious.

(2) J. R. J. writes: I have a pair of engines 2 inches stroke, 1 inch bore, of which I want to make a locomotive; will you give the dimensions, to wit, length, diameter, and thickness of copper plate of boiler; length, width, height, and thickness of copper plate of fire box; length of smoke box, and number of tubes; to burn charcoal; size of rivets; width, depth, and thickness of bed plate and frame of cast iron; diameter and gauge of one pair of driving wheels for high speed; diameter of leading and trailing wheels; diameter of driving shaft? A. Length of boiler 16 inches, diameter of boiler 4 inches, thickness of shell $\frac{1}{8}$ inch, heads $\frac{1}{16}$ inch, fire box 3 inches wide, 4 inches long, 4 inches high, smoke stack 6 inches above top of boiler, 20 tubes $\frac{1}{2}$ inch, rivets $\frac{1}{16}$ inch. Bed frame of small angle iron or $\frac{1}{4}$ inch by $\frac{1}{2}$ inch flat iron. Drivers 5 inches, truck wheels 2 inches, shaft $\frac{1}{2}$ inch.

(3) G. C. S. asks why a gas engine has explosions at one end of its cylinder only, and why not at both ends? A. Principally on account of the complication of mechanism required to secure the double action.

(4) J. E. W. desires a receipt for making a low priced red paste, soluble with water on a brush, to be used with a stencil. A. Take of shellac 2 ounces, borax 2 ounces, water 25 ounces, gum arabic 2 ounces, and of Venetian red a sufficiency. Boil the borax, shellac, and some water until they are dissolved, add the gum arabic and withdraw from the fire. When the solution has become cold, complete 25 ounces with water, and add more red to bring it to a suitable consistency.

(5) W. K. McL. writes: I would like to get a recipe for making a liquid glue or cement for use in a printing office for padding bill headings, note heads, etc.? A. Soak highest grade of glue in water for 10 minutes, and then dissolve to thin consisteney; for every fifty pounds of glue add 9 lb. of glycerine. Color with aniline or cochineal, dissolving the coloring matter in a little alcohol before adding to the glue.

(6) E. S. writes: I have a small gas pressure governor containing mercury, which is exposed to the air. Will a thin layer of glycerine on the surface of the mercury be a good way to prevent or retard the evaporation of the latter. Can you tell me of something better than glycerine for the purpose? A. Glycerine is excellent. We can recommend nothing better.

(7) W. A. J.—You cannot effectually restore the depolarizers in a Leclanche battery, as natural binoxide of manganese is used in them. You can boil out the porous cups first with water and then with weak hydrochloric acid, and finally wash in running water.

(8) J. L. P. asks: 1. What fluid or liquid boils at the lowest temperature, and at what degree Fah.? A. The range of boiling points is very extended; hydrogen has been liquefied, and its boiling temperature is several hundred degrees below 0° Fah. The liquid paraffine pentane boils at 100·4° Fah., and a liquid could be found for almost any desired boiling point. 2. What proportion of its bulk will mercury or quicksilver expand if its temperature be raised 100° Fah., say from 20 to 120? A. In absolute expansion about one ninety-ninth of its bulk. 3. Can mercury be kept any length of time in any receptacle other than glass? A. It can be kept in receptacles of iron, wood, gutta percha, paper, and many other materials. 4. Will it evaporate? A. It evaporates a little at the higher summer temperatures. 5. By what law is it possible for a cat, if suspended by her four feet or paws one or more feet from the ground, and suddenly released, to make the turn, and alight square on the feet every time? A. The cat turns by her own muscular force.

(9) Timothy writes: 1. There is a chemical combination with which paper may be saturated, and if the latter is then exposed to a current of electricity, decomposition takes place and a blue mark shows the point of contact. Does the paper require to be moist when the current is applied, or will decomposition take place on dry paper, and about how strong a current is necessary? A. The first compound consists of one part saturated solution of ferrocyanide of potassium, one part saturated solution of nitrate of ammonium, and two parts of water. Some moisture is necessary, but the paper may be practically dry. 2. Is there any chemical combination that will produce a black mark or any other color by electric decomposition? A. A solution of iodide of potassium produces a mark that verges on black, but that is temporary only. For either solution use a current of three or four volts E. M. F.

(10) B. W. E. desires a receipt and method of pickling oysters or shrimps so that they will keep well and for long periods when put up in glass jars or tin cans. A. Take 100 large oysters, 1 pint white wine vinegar, 1 dozen blades of mace, 2 dozen whole cloves, 2 dozen whole black peppers, 1 large red pepper broken into bits. Put oysters, liquor and all, into a porcelain or bell metal kettle. Salt to taste, heat slowly until the oysters are hot, but not to boiling. Take them out with a perforated skimmer, and set aside to cool. To the liquor which remains in the kettle add the vinegar and spices. Boil up fairly, and when the oysters are almost cold, pour over them scalding hot. Cover the jar in which they are, and put away in a cool place. Next day put the pickled oysters into glass jars with tight tops. Keep in the dark, and where they are not liable to become heated. Treat the shrimps similarly.

(11) F. P. P. asks: How much electricity will 1 square foot (surface) of zinc and the same amount of carbon give in a solution of salt and water equal to ocean water? How much carbon should be used to one square foot of zinc? Will copper work as well as carbon, and how much should be used? A. Using carbon, you will get about three-tenths volt, and 1 to 3 amperes through a low resistance circuit. Copper will give considerably less than carbon. Use as much carbon as zinc, or if you prefer it, use one-half the area, and bend the zinc around close to, but not touching, the carbon.

(12) J. G. C. asks (1) what ammonium fluoride is. A. It is a compound of ammonium and fluorine; it can be made by adding hydrofluoric acid to a solution of ammonia (aqua ammonia of commerce). 2. Is ammonium fluoride what is commercially known as white acid? A. "White acid" is the bifluoride of am-

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monium, containing nearly double the quantity of fluorine that the neutral fluoride does. 3. I also wish to make a substance of about the consistency of ordinary paint, that, when coated over glass, will corrode or rough its surface. A. Mix "white acid" with powdered sulphate of baryta and enough water. For all operations involving the use of fluoride of ammonium or of hydrofluoric acid, you must use vessels of lead or gutta percha.

(13) W. H. M. asks: 1. Is the sun always direct south at twelve o'clock? A. No. Only on 4 days in the year. It is fast or slow, varying from 0 to 16 minutes. See your almanac. 2. Has perpetual motion been discovered yet? A. No.

(14) N. D. writes: I see by the New York *Tribune* that Congress has "refused money to sheathe with copper the bottom of the new steel vessels." How can copper be fastened to bottoms of steel or iron vessels? A. A wooden skin is bolted on over the iron or steel hull, and the copper fastened to the wood, it being necessary to completely isolate the copper from the iron, to prevent galvanic action.

(15) E. M. W. asks how to clean a violin bow that has become greasy and will not hold resin. A. Rub carefully with best yellow soap on a small piece of flannel, then wipe dry with a piece of calico or linen; in an hour afterward it will be ready for the resin; or use a solution of borax and water.

(16) A. V. C. desires formulas for embalming fluid (face tint) and chemical razor, such as are used by undertakers, the last named being a preparation for removing hair. A. The face tint consists simply of an embalming fluid, for which there are numerous receipts, one of which is to mix together 5 pounds dry sulphate of aluminum, 1 quart warm water, and 100 grains arsenious acid. See articles on embalming in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 51 and 155. The chemical razor is an ordinary depilatory, consisting of sulphide of barium or calcium.

(17) J. R. T. asks how to get a red color on yellow brass castings after they are cast, without using any acid; also a good flux for brass. A. The peculiar orange or red color is due to the quality of the metal and manipulation after pouring. Yellow brass will not produce the color to any extent. A composition of tin and copper, such as used for valve work, will come out of a brilliant color by dipping in water a few minutes after pouring. A little pulverized charcoal is all that is useful as a flux substitute in brass melting.

(18) T. E. K. asks: 1. What can be done to Russia iron when it rusts or to prevent it from rusting? A. Rub down the surface with plumbago and linseed oil. 2. How is starch made to give linen a gloss? A. See answer to query 15 in our issue of February 26.

(19) C. F. B. asks: What will remove dandruff from a person's head without injury to the skin or hair? A. Take a thimbleful of powdered refined borax, dissolved in a teacupful of water; first brush the head well, then wet a brush and apply the mixture to the head. Do this every day for a week and then at longer intervals. Thorough cleanliness and frequent, but not violent, brushing, at least every night as well as morning, will generally keep the head free from dandruff.

(20) C. S. F. asks what gumwood is good for, also if it is subject to dry rot or attack by worms? A. It may be used for water pipes, as in the salt works at Syracuse; it is also good for hatters' blocks, wheel naves, and cog wheels. The wood is close and tough and resists splitting, though it decays sooner on exposure to the weather than elm.

(21) J. H. M. asks how to mix a good bright acid dip for brass work previous to lacquering. A. Clean the articles in strong nitric acid for a few seconds, or 2 parts nitric, 1 part sulphuric, 1 part salt. Wash in hot water.

(22) J. A. W. writes: Can you recommend something, as a liquid, or in any other form, which can be rubbed on a horse to keep off horse flies? A. Procure a bunch of smartweed, and bruise it to cause the juice to exude. Rub the animal thoroughly with the bunch of bruised weed, especially on the legs, neck, and ears. This remedy is said to be good against flies or other insects for 24 hours. The process should be repeated every day.

(23) J. W. H. writes: Are intermittent springs a reality or a myth? If a reality, what is the probable cause? A. Intermittent springs are a reality, and are caused by peculiarities in the underlying rock formation, by which water accumulates in cavities with a siphon outlet, so that the cavity fills and starts the siphon, which runs until the cavity is emptied or the action broken. Other intermittent springs depend upon the rains, perhaps, falling in distant districts for their flow. Their times are not measured with regularity.

(24) R. C. P. writes: I inclose you herewith specimens of mineral for your examination, found in this town while drilling for an artesian well, at a depth of about thirty feet. A. They are pieces of the drill point which have broken off and become rounded by the attrition.

(25) J. C. asks: The magnet in the tube of ear piece to the Bell telephone appears to be wound by two or three wires twisted together and treated as one. What is reason for this, and how are ends of the wires joined if this is the case? A. The bobbins are wound with a single wire, but its end is attached to several terminal wires to guard against breakage.

(26) A. O. W. asks who the inventor of the spectroscope was. A. In 1860, Professor Robert W. Bunsen and Gustav Robert Kirchoff, both of Heidelberg University, jointly invented spectroscopic analysis. Any prism may be termed a spectroscope, but the modern spectroscope may be assigned to 1860, and to the above as inventors.

(27) E. N. B. asks whether a wheel mounted on a shaft having suitable bearing, and placed under a magnet of sufficient power to counteract the force of gravity, and all inclosed in an air tight receiver, and a perfect vacuum formed therein, would, after being started, come to a state of rest? A. The wheel would come to rest very quickly; currents of electricity would be induced by the motion, and this would involve an expenditure of energy.

(28) J. W. V.—A current is only produced in a secondary coil when the current in the primary undergoes some alteration. If the primary current is stopped or diminished in any way, a current is induced in the secondary in the same direction. If the primary current is started or increased, the current in the secondary is in the inverse direction.

(29) D. H. asks: 1. How much power is required to work a set of telegraph instruments one hundred yards distance? A. For telegraph instruments use about four gravity cells. 2. Would a dressing of wood ashes be beneficial to onions? If so, state when, how, and the quantity required to the acre? A. Wood ashes are an excellent dressing. Use from two to five tons to the acre. 3. When stable manure cannot be had, would pea vines plowed in answer as well? A. Pea vines plowed in would be a very poor substitute for manure.

(30) Young Blacksmith.—Ordinary malleable iron castings cannot be welded. The central part is not perfected in the annealing process. Malleable iron shears and other cutlery that is steel faced are made of good iron, and thoroughly annealed, so as to be homogeneous throughout the piece. Then the welding may be done in the ordinary way, with borax flux. The welding of cast steel of high grade is rather difficult, but can be done with borax. It is better to use double shear steel, which answers well for cutting tools and may be readily welded to iron or to itself with borax flux. Clock springs are tempered by dipping in a pot of lead heated to a cherry red, then in oil to harden. Draw the temper in boiling oil. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 95, 103, 105, 397, 221, 222, on Hardening and Tempering Steel.

(31) I. A. T. asks the correct mixture for making German silver. A. For fine German silver:

49 parts	Copper.
24 "	Zinc.
24 "	Nickel.
2½ "	Aluminum.

All by weight. There are alloys of many other proportions that are recognized as standard.

(32) A. F. D. wishes to know what the pressure of water would be at the lower end of a pipe line 5½ miles long with an average grade of 150 ft. to the mile. Also if hot water from hot springs would lose any of its heat in running through the above named pipe. A. There will be 354 pounds per square inch pressure at the lower end when the water is at rest or not being drawn. If pipe is left open for free running from the full orifice of pipe, the friction of the water will largely lessen the pressure. The heat lost will depend upon the size of the pipe and velocity of the water, as well as the protection it may have from radiation.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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April 12, 1887,

AND EACH BEARING THAT DATE.

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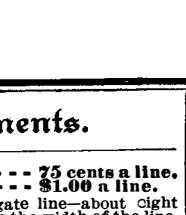

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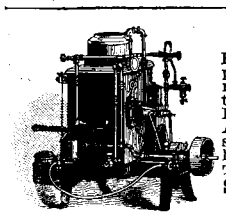

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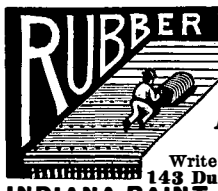
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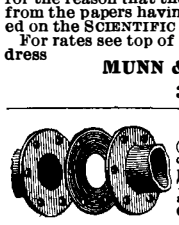
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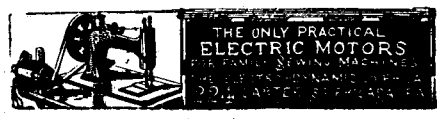

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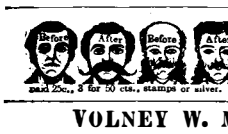

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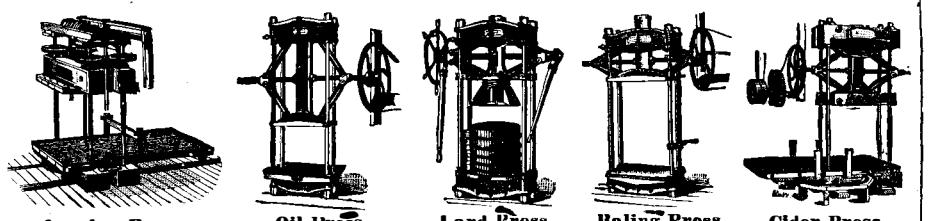
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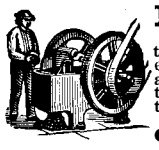

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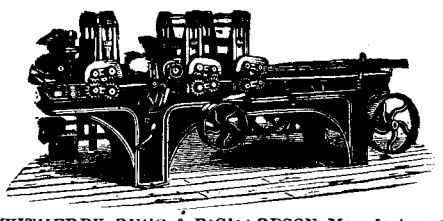
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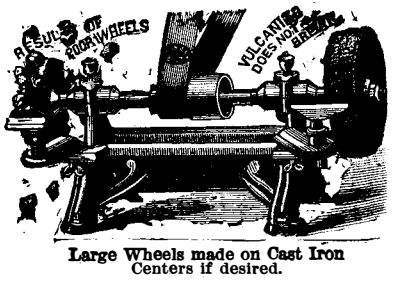

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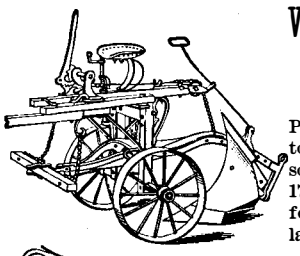

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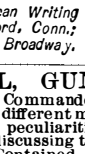

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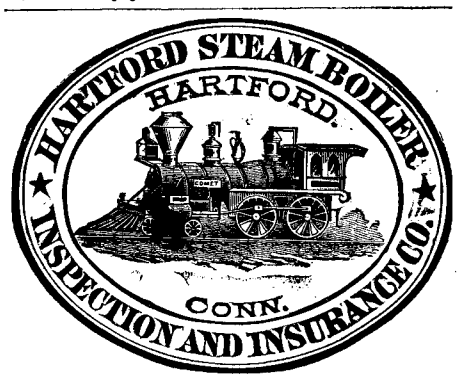

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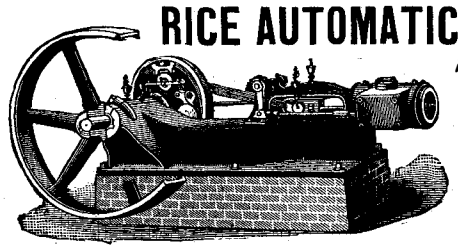

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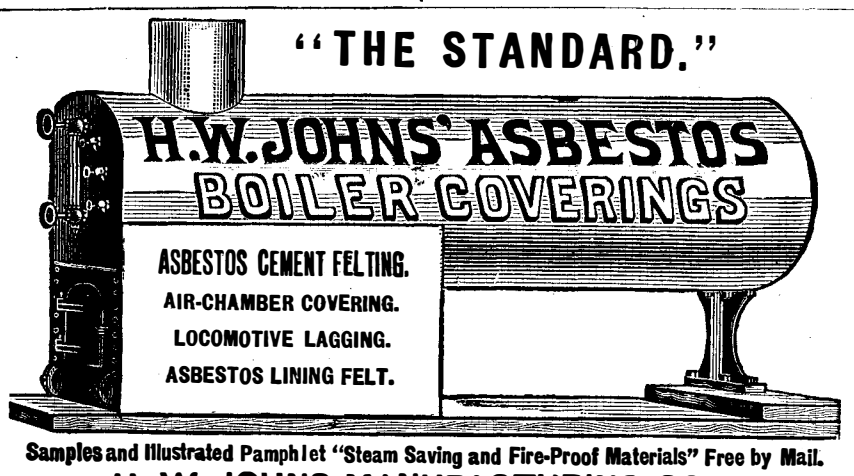

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